10.21608/MEAE.2023. 244340.1234

المجلة المصرية للإقتصاد الزراعي
ISSN: 2311-8547 (Online), 1110-6832 (print)
https://meae.journals.ekb.eg/

أثر إستخدام التكنولوجيا الحديثة على انتاج محصول بنجر السكر

د/ داليا محمود نصر البطران **أ.د/ يحيي محمد متولى خليل**
قسم الاقتصاد الزراعي، معهد البحوث الزراعية والبيولوجية، المركز القومي للبحوث.

المستخلص

تهدف الدراسة إلى التعرف على أثر إستخدام الحزمة التكنولوجية المتكاملة على |إنتاج محصول بنجر السكر، والتى ينعكس تأثيرها على المؤشرات الانتاجية والاقتصادية للمحصول وذلك من خلال عينة الدراسة الميدانية بمحافظة الدقهلية. حيث تبين الأثر الايجابي لاستخدام هذه الحزمة، وأوضحت النتائج أن أهم العوامل المؤثرة على إنتاج بنجر السكر هى السماد الأزوتي، المغذيات، والعمل الآلي. كما تبين من إستخدام إسلوب المتغيرات الصورية أثر إستخدام العمل الآلي فى إنتاج المحصول بعينة الدراسة والذى أدى إلى زيادة إنتاجية عنصري السماد الأزوتي، والمغذيات وبالتالى إنتقال دالة العر ض لكل منهما بنحو 0.357، 0.036 طن على الترتيب. كما تبين من استخدام بعض المؤشرات الانتاجية والاقتصادية تفوق هذه المؤشرات فى حالة إستخدام الحزمة التكنولوجية التكنولوجية، لذا فإن الدراسة توصى بضرورة التوسع فى تطبيق الزراعة التعاقدية لمحصول بنجر السكر والتى تساهم فى توفير الدعم النقدى للمزارع مما يساعده فى استخدام الحزم التكنولوجية الحديثة، ضرورة إستخدام الحزمة التكنولوجية فى إنتاج بنجر السكر لزيادة الانتاج والذى بدوره يساهم فى خفض الفجوة من المحاصيل السكرية، كذلك زيادة صافى العائد .

بيانات البحث

استلام 2023/10/ 23
قبول 2023 / 12 / 7

الكلمات المفتاحية:
بنجر السكر، دوال الانتاج، المتغيرات الصورية، المؤشرات الإنتاجية والاقتصادية.

الباحث المسئول: داليا محمود نصر البطران
البريد الإلكتروني: modern_e@ymail.com

10.21608/MEAE.2023. 244340.1234

Available Online at EKB Press
Egyptian Journal of Agricultural Economics
ISSN: 2311-8547 (Online), 1110-6832 (print)
https://meae.journals.ekb.eg/

The impact of using the modern technology on sugar beet production

Dr.Dalia M. Nasr El Batran **Prof. Dr. Yehia M. M. Khalil**
Department of Agricultural Economy, Agricultural and Biological Research Division, National Research Centre

ARTICLE INFO

Article History
Received:23-10- 2023
Accepted:7- **12- 2023**

Keywords:
Suger Beet, DummyVariables, Production function, Productivity and economic indicators.

ABSTRACT

The study aimed to identify the impact of using an integrated package of modern technology on the production of the sugar beet crop, which was reflected on the productive and economic indicators of the crop, through a sample for sugar beet producers in Dakahlia Governorate, Where the positive effect of using this package was shown, and the results of the study showed that the driving factors of the production for the sugar beet crop are the nitrogen fertilizer, the value of pesticides, and labor. While the most important of these factors were represented in the case of using the technological package are the nitrogen fertilizer, the quantity of nutrients, and the mechanical work. Using dummy variables, the study showed the impact of the use of mechanical work on the productivity of major factors affecting crop production in the sample of the technology package, as it showed that the use of mechanical work led to an increase in the productivity of the two elements of nitrogen fertilizer and nutrients, and then led to a shift in the supply function by about 0.357 and 0.036 tons. of sugar beets, respectively. Through some productive and economic indicators, the study showed the relative superiority of farmers who use the technology package over their who do not use the technology package. So The study recommends the importance of expanding for the contract farming of the sugar beet crop, as well as the need to apply the technological packages to improve and increase production and then increase the net yield, which will lead to a decrease in the Egyptian sugar gap.

Corresponding Author: ***Dalia Mahmoud Nasr EL Batran.***
Email: **modern_e@ymail.com**

10.21608/MEAE.2023. 244340.1234

Introduction

Sugar beet crop is one of the most important strategic crops in Egypt, as it is one of the most important sugar crops, especially under the water challenges which facing the cultivation of the sugar cane crop. Under different conditions. It is mainly grown for the purpose of producing roots, which contain 15-20% of sucrose, about 5.5% of dried fodder, in addition to 6.5% of molasses. If several elements are available in the beet sugar industryThe percentage of sugar increases, which the most important of them are the efficiency and performing of operations, services and marketing channels. Especially, the process of transporting the supplied crop to the factory within 48 hours of the harvesting process. In addition to the need to apply technological packages such as laser leveling, and drip irrigation, as beet roots go deep to about 30-50% under the soil.

Dakahlia Governorate is the second in terms of the cultivated area of sugar beet crop in Egypt, which amounts to 96 thousand feddan, representing about 14.1% of the average area in Egypt, which amounts to 539.76 thousand feddan during the period (2019-2021), The amount of sugar beet production in the governorate is about 2,122 million tons, representing about 20.2% of the average beet production in Egypt, which amounts to about 10,513 million tons during the period under study.

Research problem :

Despite the application of contract farming to the sugar beet crop and the Country efforts to face the food gap of sugar, However, the gap is still increasing as a result of the inability of the total production to meet the increasing consumption needs as a result of the continuous increase in the population. Also, the economic and productivity efficiency of the crop was not clear, in addition to the difficulties that encountered the producers in the production and supply of the crop, such as delaying the delivery of production to the factory, which leads to infection with fungi that cause mold, and a decrease in sugar. Which requires expanding the application of appropriate modern technological methods to increase the production.

Research Objectives:

The research aims to study the effect of using an integrated package of modern technological methods in the production of the sugar beet crop, which leads to an increase in the amount of production and the net return of the farmers, through some sub-objectives:

1- Studying the production functions of the sugar beet crop to identify the most important factors that affecting the production.

2- Studying the effect of applying the integrated technology package on the production of sugar beet crop, which is (using improved varieties of seeds with high concentrations of sugar, mechanical work, which includes laser leveling, mechanized cultivation using secateurs, and mechanized harvesting).

3- Estimating the optimal size and the maximum size of the profit to access the lost income of the production stage in the case of users of technology packages and non-users.

Methodolgy:

The study is based on descriptive and quantitative economic analysis through statistical and econometric methods. The stepwise regression analysis method was also used to estimate the production functions in the linear and logarithmic forms, To determain which method is best and whose results are consistent with economic and statistical reasoning, and to identify the main factors affecting the sugar beet production. Dummy variables were used to show the effect of using the integrated technology package on sugar beet production.

The Sample:

Dakahlia Governorate is the second in terms of the cultivated area of sugar beet crop in Egypt, which amounts to 96 thousand feddan, representing about 96.06 thousand feddan, representing about 18.55% of the total crop area in Egypt for the season (2021/2022). Centers were chosen in terms of the area cultivated with the crop. So, the Al-Hafir region and Belqas centers were chosen, as the area for each of them, respectively, was about 27.6 and 25.87 thousand feddan, which represents about 28.74% and 26.94% of the total area of sugar beet. in Dakahlia.

It is clear from Table No. (1) that the villages Al-Markazia and Al-Sa'ada in Al-Hafir region were selected, with an area of each of them about 2865 feddan, 1640 feddan, which about 28.73%, 16.45% of the total area of the sugar beet crop in Al-Hafir region for the season (2021/2022). The villages Al-Stamuni and Al-Rawda were selected from Belqas center, as the area of the sugar beet crop in each of them reached about 3303 and 2162 feddan, respectively, representing about 33.13% and 21.69% of the sugar beet crop area in Belqas center.

A deliberate random sample of 360 farmers, including about 65 farmers, who used the integrated technology package, was chosen. Whose use mechanical work which includes (laser leveling that leads to tightening the irrigation process as a result of the regular arrival of water in specific quantities at the same time. As the accumulation of water, especially in heavy soils, dwarfs plants and weakens their growth, as well as leads to an increase in germination rates due to the regularity of water reaching all seeds, as well as mechanized cultivation using a pick or planter, and automated harvesting) and the use of varieties with high productivity and high concentrations of sugar.

Table 1. Relative importance cultivated area and number of holders of sample Villages in Dakahlia .

Center	Village	Village area	% Village area to Sample area	Holder Number	%Holders Number to sample number	Geometric Mean	Sample Size
Al-Hafir region	Al-Markazia	2865	28.73	1591	28.48	28.65	103
	Al-Sa'ada	1640	16.45	736	13.17	14.75	540
Belqas center	Al-Stamuni	3303	33.13	2110	37.77	35.43	127
	Al-Rawda	2162	21.69	1150	20.58	21.17	76
Total Samlpe area		**9970**	100	5587	100	100	360

Source: it was estimated and calculated from the Directorate of Agriculture for the new lands in Nubaria, statistics records, Statistics Department (2021/2022).

Results and discusion:

First: Sugar beet production function for users and non-users of technology packages:

More than form was used to identify the driving factors of sugar beet production, and it was found that the double logarithmic is the best form. The production elements were: the quantity of seeds (X_1), the quantity of municipal fertilizer (X_2), the nitrogen fertilizer's amount (X_3), the quantity of phosphate fertilizer (X_4), the amount of potasium fertilizer (X_5), the amount of nutrients (X6), the cost of pesticides (X_7), the amount of irrigation water (X_8), labor (X_9), mechanical work (X_{10}).

10.21608/MEAE.2023. 244340.1234

1-production function of the sugar beet crop for non-users of the integrated technology package:

It is clear from Equation No. (1) in Table No. (2) the results of the production function of the sugar beet crop for non-users of the technology package using the double logarithmic form. Where it was found that by increasing the nitrogen fertilizer (X_3) by about 1%, sugar beet production Increase by approx 0.151%, and it was also shown that by increasing the cost of pesticides (X_7) by about 1%, it causes an increase in production by about 0.062%, also it was found that by increasing labor (X_9) by about 1 %The quantity produced of beets increased by 0.307%. This indicates that production for these resources takes place in the second stage with decreasing marginal productivity. And The total elasticity reached about 0.520%, as it is less than one, which reflects the decrease in the return on capacity. It was shown that R^2 reached 0.55, that reflects the influence of the previous factors on production.

Table No. (2) The production function of Sugar Banger using the logarithmic form for the study sample

Statement	Eq.	The equation	R^2	F
without the use of technology packages	1	Ln Y = 0.885 + 0.151Ln X_3 + 0.062 Ln X_7+0.151 Ln X_9 (2.8)** (3.4)** (2.4)*	0.55	14.7
Technology package users	2	Ln Y = 2.6+ 0.117 Ln X_3 + 0.072Ln X_4+0.081Ln X_7 + 0.186Ln X_{10} (4)** (4.8)** (2.2)* (3.7)**	0. 79	20.3
using dummy variables	3	Ln Y = 2.2 + 0.082Ln X_3 + 0.122Ln X_6+0.271 LnX_{10}+ 0.334 D (3.74)** (3.2)** (11.8)** (3.5)**	0.93	551

Where:

Ŷi =. The volume of sugar beet production is estimated at one ton

Xi1 = the estimated seeds by seedlings Xi2 = the quantity of municipal fertilizer

Xi3 = the number of nitrate for Fadden(the number of units)

Xi4 == the number of phosfat per Fadden(the number of active units)

Xi5 = = the number of possum per Fadden(the number of active units. Xi6 == the quantity of nutrients (m3).

Xi7 =the value of the pesticide (L.E). Xi8 == the quantity of irrigation water (m3).

Xi9 = the quantity of labor (man /.day/work).

Xi10 = the quantity of mechanical work by hours(hour/Fadden

Xi= 1, 2, 3, number of farmers in the area.

**: refer to Significant at the level of 0.01 * significant at the level of 0.05

Source: Computed from the sample forms of the study in Dakahlia Governorate (2022) .

2- production function of The sugar beet for the technology package users

The results of equation No. (2) in Table No. (2) shows the impact of using the integrated technology package on the production of the crop. Where it is clear that by increasing the element of nitrogenous fertilizer (X_3) by 1%, the production of sugar beet raises by about 0.117%, and it is also clear that by increasing the phosphate fertilizer (X_4) by about 1%, it causes a raises in production by about 0.076%. The results shows that by increasing Nutrients (X_6) by about 1% led to an increase in beet production by about 0.081%, and it was found that by

increasing the mechanical component (X_{10}) by about 1%, it leads to an increase in sugar beet production by about 0.186%. This indicates that the production for these resources takes place in the second stage with decreasing marginal productivity, and the total elasticity reached about 0.460%, as it is less than one, which reflects the diminishing return on capacity. The coefficient of determination was 0.79, that means the effect of the previous factors on production.

3- Estimating the production function using dummy variables

It is clear from Equation No. (3) in Table No. (2) the estimation of the production function of the sugar beet crop using the dummy variables method, to identify the effect of the integrated technological package on the production, and the statistical significance of the dummy variables of the used technology package (D1) was confirmed, which means the positive effect of it on sugar beet production. Where it was found that by increasing the nitrogen fertilizer by about 1%, it leads to an increase in production by about 0.0821%, and it was also found that by increasing the fertilizers or nutrients by about 1%, it leads to an increase in production by about 0.122%, and when the number of mechanical work increases by about 1%, the quantity produced increases by about 0.271%, and it was shown that R2 was about 0.93, which means the impact of the previous factors on production. The positive significance of the dummy variable was confirmed, which means that users of the technology package in the beet crop have an increasing effect on acreagethe productivity in the study sample, which means that it is preferable for the producer to improve and increase the productivity by using the technology package.

Second: Shiffting of the production function for suger Beet using dummy variables:

To determain the difference source using dummy variables, The model used can be explained as follows.

$Yt=a+b_1X+b_2D+b_3 X_i D_i$

Where:

Y_t = dependent variable.

X_i = the independent variable (the factor that has a significant effect on production)

D = a dummy variable which take (zero) for not using the technologies and (one) for the user of the technology.

From this equation, non-technology users equation can be derived as follows:

$Y X_1=a+b_1 X$

technology users can also be derived as follows:

$Yx_2= (a+b_2) + (b_1+b_3) X$ or $Yx_1=a+B X$

The effect of using the technological package on shiffting of the sugar beet crop production function:

It seems from the equations of table No. (3) the effect of using the technological package used in the production of the sugar beet crop using the method of dummy variables, as it shows the significant effect of the mechanical work element that was used in leveling the land with laser, As well as the use of mechanized farming using stratum, and mechanized harvesting on the productivity of production factors. and It is clear how the production function for the elements of the technology package shifts. Where multiple regression was used, which the dependent factor is the amount produced of sugar beet per ton (Y), and the independent factors are the amount of the productive elements involved during production, which was confirmed by statistical significance (X). Then the dummy variable (D) is entered and expressed in the function with the value (zero) for non-users of technology and the value (one) for users and expressed in the function by the variable (D1) and then the variable (X) is multiplied by the dummy variable (D1) to get (D1X). According to the significance of the elements, the significance of the mechanical work was confirmed. Equation

No. (1) in Table No. (3) shows that the use of mechanical work led to an increase in the productivity of the nitrogen fertilizer, which led to a shift of the supply function by about 0.357 tons of sugar beets. As it is clear from Equation No. (2) in Table No. (3) that the mechanized work led to an increase in the productivity of the nutrient which led an increase in the supply function of sugar beet by about 0.036 tons.

Table No. (3) the effect of using the technology of laser leveling, Nitrogenous fertilizer and nutrients on shifting the production function for suger beet crop in the sample.

Element	Technology	The equation	R2	F	effect
Nitrogenousfertilizer	**laser leveling** **Mechanized farming** **Automated harvest**	$\hat{Y} = 18 + 0.255\ X_3 + 5.1 D_1 + 0.102\ D_1 X_3$ $(2.6)^{**}$ $(4.9)^{**}$ (0.84) $\hat{Y} = 18 + 0.255\ X_1$ $\hat{Y} = 23.1 + 0.357\ X_1$ (1)	0.95	518	0.357
Number of nutrients	**laser leveling** **Mechanized farming** **Automated harvest**	$\hat{Y} = 14.9 + 0.033 X_6 + 9.4\ D_1 + 0.003\ D_1 X_6$ $(4.3)^{**}$ $(10.1)^{**}$ (0.87) $\hat{Y} = 14.9 + 0.033 X_6$ $\hat{Y} = 25.3 + 0.036 X_6$ (2)	0. 94	426	0.036

Source: Computed from the sample forms of the study in Dakahlia Governorate (2022) .

Third: Cost function for sugar beet producers in the study sample:

The most important derivatives of the cost function can be obtained from the following equations:

$$TC = a + b_1 X + b_2 X^2$$

$$AC = \frac{a}{x} + b_1 + b_2 X$$

$$MC = b_1 + 2\ b_2 X$$

Whereas TC= Total cost of onions per pound / feddan
X = Feddan yield kg / feddan
AC= average costs per pound / feddan
MC= Marginal costs per pound / feddan

1-Estimating the production cost function for non-users of the technology package in sugar beet production

By studying the relationship between the production costs of non-users of technology packages for sugar beet and the quantity produced of the crop in tons, the quadratic and cubic methods were used to choose the best method from the economic and statistical point. Where the equation No. (1) in Table No. (4) shows Correlation between production volume and total costs per ton of sugar beet production, which showed that there is a statistically direct Correlation between the total costs and the production of the crop, The value R^2 was 0.59, which indicate that approx. 59% of Changes in

10.21608/MEAE.2023. 244340.1234

total cost are driven by changes in output. The average cost and the marginal cost functions were derived, and the optimal production was determined, which is the lowest cost, and was estimated at 21.2 tons/feddan. While The average crop per feddan was about 20 tons/feddan. The results showed that about 120 farmers have achieved this size. The maximum size of the profit was also determined, as it was about 25.85 tons/feddan, and this size was not achieved by any producer. This indicates that Farmers still have opportunities to increase production and maximize their profits through vertical expansion and use of modern technological methods. The average price of a ton of sugar beet was about 990 pounds/ton.

Table No. (4) Cost Functions of sugar beet for non-users and users of technology packages in the sample

Equation	R^2	F
$TC\ i = 3470.2-594.2X_i +7.73\ X_i^2$ (2.68)** (.8)** (3.10)** $AC = 594.8+7.73\ X +3470.2X^{-1}$ $MC = -594.2 + 15.47X$	0.57	26.2
$TC\ i = 184539.4-12625.7X_i +246.8\ X_i^2$ (2.68)** (-2.8)** (3.10)** $AC = - 12625.7.7 +246.8\ X + 184539.4X^{-1}$ $MC = - 12625.7 + 493X$	0.47	16.7

Where:

Tc i = Total cost of Bangor production
Xi_1 = the quantity of Bangor production estimated per ton.
AC= average costs per pound / Feddan
MC= Marginal costs per pound / Feddan
i= 1, 2, 3, number of farmers in the area.
** :Significant at the level of 0.01. * significant at the level of 0.05.

Source: Computed from the sample forms of the study in Dakahlia Governorate (2022) .

Estimating the production costs function for the users technology package in the study sample.

It is clear from the second equation in Table No. (4) that there is a direct statistically relationship between the total costs and the production of sugar beet, and also it was shown that the value of R^2 0.47, which reflect that about 47% of Changes in total cost are caused by changes in output.. The average cost, and the marginal cost function were derived, and the optimal production volume was determined, Also the lowest costs was estimated at about 27.35 tons/feddan. While the average production per feddan for the users of the technology package was about 28 tons/feddan. It was clear from the results that fifty-three farmers have achieved this size. The maximum size of the profit was also determined, as it was estimated at about 27.62 tons/feddan, and it was found that about thirty-five farmers of the number of producers had reached this size, and it was also found that some of them had exceeded this size, which mean that there is an opportunity for some of farmers to increase their production to maximize their profits.

Productivity and economic indicators of the sugar beet crop in the study sample:

It was possible to estimate some productive and economic indicators for users and non-users of the integrated technology package, which were:

1- Productivity per feddan :

It is clear from Table (5) that the average actual production of sugar beet crop for traditional farmers who do not use the technology package was about 20 tons/feddan, while the average productivity per feddan for farmers using the technology package was about 28 tons/feddan.

2- total revenue:

It is clear from Table (5) that first: for Non-technology package users, the actual total revenue amounted to about 19404 pounds, while for farmers who achieve the optimal volume of production, which lower costs , it amounted to about 20988 pounds. As for farmers using the integrated technology package, the average actual total revenue amounted to about 27,497 pounds. Secondly, for farmers who achieved the equal civil volume of costs, the total revenue amounted to about 27,027 pounds, and the total revenue for producers who achieved the maximum profit amounted to about 27,770 pounds.

3- Average cost of the produced unit:

The results of a sample study for non-users of the technology package of sugar beet production showed that the total costs were estimated at 18104 pounds per farm, and that the average cost per ton was about 923.7 pounds/ton, The optimal size of production which minimize the costs was 21.2 tons, at an average total cost of 853.9 pounds, and the average cost of unit in the case of a profit volume was achieved about 365.5 pounds/ tons. It was also found that the average cost of ton amounted to about 683 pounds, while the total costs were estimated at 18766.3 pounds.

Table No. (4) The volume of production and the lost profit of the sugar beet producers to use technological packages and not users in the study sample in Dakahlia Governorate

Statement	Non-technology Users			technology Users		
	Actual production	Optimal production	Great production of profit	Actual production	Optimal production	Great production of profit
Production (ton)	20	21.2	49.5	28	27.4	28.05
Farm price (pound/ton)	990	990	990	990	990	990
total revenu (pound)	19404	20988	49005	27497	27027	27770
The total cost(pound)	18104	18404	18404	18731	18731	18731
The cost of ton	523.7	853.9	365.5	669	683	667.8
The return of feddan	1300	2884	30901	8766	8296	9039
Lost profit	--	1584	29601	---	470-	272.2

Source: Computed from the sample forms of the study in Dakahlia Governorate (2022) .

4-Lost profit:

By studying the costs of the sample, the lost income can be estimated, which is the difference between the total revenue of optimal production (which minimize costs) or the production which maxmaize profit and total return at the volume of actual production. Where it is clear that the level of the actual return of the non -technology users amounted to about 1300 pounds. As for the non -users of technology and the civilized investigators of the costs, the lost profit reached

about 1584 pounds, while it reached about 29,601 pounds for not achieving the maximum production.
As for the users of the technological package, the level of the actual return reached about 8766 pounds, while the results show that technology users achieved the minimum cost of costs had the opportunity to increase the profit by about 470 pounds, which is the value of the lost profit, and for technology users who managed to achieve the size of production which maxmaize the profit They have no lost.
The results of the study showed to the producers, it became clear that it is 20 tons per feddan at an average actual cost per ton 923.7 pounds/ton, and the actual cable costs were estimated at 18104 pounds for the farm, thus the real profit is 1300 pounds.

References:

Abbas. Elham. A., Ali, E. H., An economic study of the efficiency of using agricultural resources in sugar beet production in Dakahlia Governorate, Egyptian journal for agricultural economics, Vol. (28), Iss. (2), June (B), 2018.
AlNafaily. Al Hussiany. A., Mussa. T. M., An analytical study of the productive and economic efficiency of sugar beet production on old and new lands in Dakahlia Governorate, Egyptian journal for agricultural economics, Vol. (29), Iss. (2), June (B), 2019.
Muhammad. A. Al-Sayed, Economics of water management in lands affected by salinity in Sharkia Governorate - PhD - Department of Agricultural Economics , Faculty of Agriculture - Zagazig University 2014.
Ghoneim. Shehata. Abdel. , and others - An economic study of contract farming of sugar beet crops (a case study in Gharbia Governorate), Egyptian Journal of Agricultural Economics , Vol.(27), Issue (3), September 2017.
Abdel Tawab. Doaa. , An analytical study of foreign trade in sugar in Egypt - PhD- Department of Agricultural Economics, Faculty of Agriculture, Fayoum University 2020.
Yehia M.M, Estimation of Standard Models Using Computer, Egyptian National Library,2020.

Summry

The sugar beet crop is one of the most important strategic crops, as it is one of the most important sugar crops, especially under the water challenges facing the cultivation of sugar beet. The problem of the study is the lack of the economic and production efficiency of the crop, in addition to the difficulties facing the producer in applying modern technological packages that work to Increasing production and achieving a net remunerative return on the product. The research aims to study the impact of using an integrated package of modern technological in producing sugar beet. the research relied on the descriptive and quantitative economic analysis, StepwiseRegression Analysis was used to estimate production functions. Dummy variables were also used to demonstrate the impact of using the integrated technological package. To conduct the study sample, Dakahlia Governorate was chosen, as it occupies second place in terms of the cultivated area. Also, the Al-Hafeer region and the Belqas Center were chosen, as the area of the crop in each of them is about 27.6 and 25.87 thousand feddan respectively, in terms of the cultivated area were also chosen. which represents about 28.74% and 26.94% of the total area of sugar beets in Dakahlia Governorate. The central village, Al-Saada, in the Al-Hafeer area were also chosen, and the villages of Al-Stamuni and Al-Rawda were chosen from the Belqas Center. using the double logarithmic form to estimate the production function for the sugar beet for non-users of the technology package, The results showed that the driving factors of sugar beet production are nitrogen fertilizer (X3), pesticide value (X7), and labor (X9). It was found that increasing each of them by about 1% leads to an increase in sugar beet production by about 0.151%, 0.062%, and 0.307%, respectively, while it was found that the most important factor affecting sugar beet crop

10.21608/MEAE.2023. 244340.1234

production for users of the technology package is the nitrogen fertilizer component (X3). Phosphate fertilizer (X4), nutrients (X6), and mechanical work (X10), thus It is clear that by increasing each of them by 1% the production increase by about 0.117%, 0.076%, 0.081%, and 0.186%, respectively. Using Dummy variables to identify the impact of the integrated technological package on the production it was found that by increasing nitrogen fertilizer, nutrients, and the number of mechanized working hours by about 1% leads to an increase in production by about 0.108%, 0.122%, and 0.271%, respectively. By measuring the effect of applying the technological package on the shifting of the supply function of the sugar beet, it was found that the use of mechanized work led to an increase in the productivity of the nitrogen fertilizer component and thus led to a shift of the supply function of about 0.357 tons of sugar beet. It also led to an increase in nutrient productivity and thus an increase in the supply function 0.036 tons. By estimating the cost function for non-users of the technology package, it was found that the optimum size of production which minimize the costs is about 21.2 tons/feddan. Where the average production was about 20 tons/feddan, while the size of production which maxmize the profit was about 25.85 tons/feddan. As for the users of the technology package, it was found that the optimum production size which minimize costs was about 27.35 tons/feddan. The average production per feddan was about 28 tons/feddan, and the maximum profit size was about 27.62 tons/feddan. By Studying some productive and economic indicators shows that these indicators are superior in the case of using the technology package.

The study concluded with a set of recommendations, the most important of which are:

1- Expanding the production of sugar beets to enable them to be grown on newly reclaimed lands.

2- The study showed the necessity of using modern technological packages (laser straightening, using modern varieties with a High concentrations of sugar, chemical fertilization, adding nutrients, and using mechanized work) by the farmers to increase their net revenue .

3- Expanding the application of contract farming in sugar beet crops between the farmers and the government, which helps farmers provide the necessary financing to use modern technology.

4- There must be trust between the producer and the crop manufacturing companies, and work on cooperative agricultural assembly with the presence of agricultural guides specialized in sugar beet cultivation to increase the cultivated area using modern technological packages.

5- Working on consolidating spaces to eliminate the small areas that makes it difficult to use large machines.

10.21608/MEAE.2023. 244340.1234

الملخص

أثر إستخدام التكنولوجيا الحديثة على انتاج محصول بنجر السكر

يعتبر محصول بنجر السكر من أهم المحاصيل الاستراتيجية، حيث يعد من أهم محاصيل السكر، خاصة في ظل التحديات المائية التي تواجه زراعة بنجر السكر. وتتمثل مشكلة الدراسة هي نقص الكفاءة الاقتصادية والإنتاجية للمحصول، بالإضافة إلى الصعوبات التي تواجه المنتج في تطبيق الحزم التكنولوجية الحديثة التي تعمل على زيادة الإنتاج وتحقيق عائد صاف مجزي على المنتج. لذا فإن البحث يهدف إلى دراسة أثر استخدام حزمة متكاملة من التكنولوجيا الحديثة في إنتاج بنجر السكر. وقد اعتمد البحث على الاسلوب الاقتصادي الوصفي والكمي، حيث تم استخدام تحليل الانحدار المتدرج لتقدير دوال الإنتاج. كما تم استخدام اسلوب المتغيرات الصورية لبيان أثر استخدام الحزمة التكنولوجية المتكاملة. ولإجراء عينة الدراسة تم اختيار محافظة الدقهلية حيث تحتل المركز الثاني من حيث المساحة المزروعة. كما تم اختيار منطقة الحفير ومركز بلقاس حيث تبلغ مساحة المحصول في كل منهما حوالي 27.6، و25.87 ألف فدان على التوالي، كما تم اختيار المساحة المزروعة من حيث المساحة المزروعة. والتي تمثل حوالي 28.74٪، و26.94٪ من المساحة الكلية لبنجر السكر في محافظة الدقهلية. كما تم اختيار قريتي المركزية، السعادة في منطقة الحفير، كما تم اختيار قريتي الستاموني والروضة من مركز بلقاس. باستخدام الصورة اللوغاريتمية المزدوج لتقدير دالة إنتاج بنجر السكر لغير مستخدمي حزمة التكنولوجيا، أظهرت النتائج أن أهم العوامل المؤثرة على إنتاج بنجر السكر هي السماد النيتروجيني (X3)، وقيمة المبيدات (X7)، والعمالة (X9). حيث تبين أنه بزيادة كل منها بحوالي 1٪ يؤدي إلى زيادة إنتاج بنجر السكر بنحو 0.151٪ و0.062٪ و0.307٪ على التوالي، كما تبين أن العامل الرئيسي لإنتاج محصول بنجر السكر لمستخدمي حزمة التكنولوجيا هو السماد النيتروجيني (X3)، الأسمدة الفوسفاتية (X4) والمغذيات (X6) والأعمال الميكانيكية (X10)، وبالتالي يتضح أنه بزيادة كل منها بنسبة 1٪ زاد الإنتاج بحوالي 0.117٪، 0.076٪، 0.081٪، و0.186٪ على التوالي. كما تم استخدام المتغيرات الصورية للتعرف على تأثير الحزمة التكنولوجية المتكاملة على الإنتاج، حيث تبين أنه بزيادة السماد النيتروجيني والمغذيات وعدد ساعات العمل الآلية بحوالي 1٪ يؤدي إلى زيادة الإنتاج بحوالي 0.108٪ و0.122٪ و0.271٪ على التوالي. وبدراسة تأثير تطبيق الحزمة التكنولوجية على إنتقال دالة العرض لبنجر السكر، كما تبين أن استخدام العمل الآلي أدى إلى زيادة إنتاجية السماد النيتروجيني وبالتالي أدى إلى إنتقال دالة العرض بنحو 0.357 طن من بنجر السكر. كما أدى إلى زيادة إنتاجية عنصر المغذيات وبالتالي زيادة في دالة العرض 0.036 طن. وبتقدير دالة التكاليف لغير مستخدمي حزمة التكنولوجيا، حيث تبين أن الحجم الأمثل للإنتاج الذي يقلل من التكاليف بلغ نحو 21.2 طن/فدان. وبلغ متوسط الإنتاج حوالي 20 طن/فدان، في حين بلغ حجم الإنتاج الذي يحقق أقصى ربح حوالي 25.85 طن/فدان. أما بالنسبة لمستخدمي الحزمة التكنولوجية فقد تبين أن حجم الإنتاج الأمثل الذي يقلل التكاليف بلغ نحو 27.35 طن/فدان. وبلغ متوسط إنتاج الفدان الواحد حوالي 28 طن/فدان، والحد الأقصى للانتاج والمعظم للربح نحو 27.62 طن/فدان. دراسة بعض المؤشرات الإنتاجية والاقتصادية تبين تفوق هذه المؤشرات في حالة استخدام الحزمة التكنولوجية.