Supply Response of Onion Crop in the Arab Republic of Egypt

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Abstract: Onions is considered one of the most important vegetable crops in Egypt due to its cultivation on a large scale compared to other vegetable crops, in addition to its importance as an important food crop. Its exports come in the fifth rank after each of cotton, rice, potatoes, and oranges in terms of its contribution to the monetary value of the total Egyptian agricultural exports. The value of Egyptian onion exports represented about 3.82% of the total value of Egyptian agricultural exports during the period (2003-2018). Despite the economic and export significance of onion crop, the cultivated area of onion is still limited, its prices are fluctuating from year to year, and the nutritional needs are increased. Consequently, Increasing the cultivated area and increasing production has become an urgent matter to meet local needs and also to achieve the competitive advantage in global markets for providing foreign currencies that contribute in Egyptian economy development (Atta, 2011). The research aimed to estimate the supply response functions of onion crop in Egypt to determine the most important economic factors affecting the cultivated area of the onion crop supply by adopting the Mark Nerlove dynamic model which considered the most famous economic model in estimating the supply response functions for its easy estimation and the ability to enter many independent variables in the model. The model assumed that: (1) studying the response of the cultivated area of onion in the current year is affected by some variables related to the crop by lagging of one year, represented in: productivity, farm price, total costs, and net profit. (2) Studying the response of the cultivated area of onion in the current year affected by some variables of competing crop (wheat, broad beans, tomatoes, clover, garlic, and sugar beet) represented in: Relative prices, Relative costs, and Relative net profits. The results indicated that the average of total revenue of onion is estimated by 11.771 thousand L.E/feddan during the period (2003-2018), also the average of total production cost of onion is estimated about 4.101 thousand L.E/feddan. Therefore, the average of net profit per feddan is about 7.670 thousand L.E/feddan during the same period. Increasing of onion productivity in the previous year by 1% leads to an increase in the cultivated area of the onion in the current year by 4.07% and 5.73% in the short run and long run, respectively.

Keywords: Onion crop, productivity, financial indicators, economic model, supply response functions

INTRODUCTION

Agricultural sector is one of the most important sectors in the Egyptian economy, as it is represented in providing food, raw materials necessary for Egyptian industries and providing foreign currencies necessary to bring the comprehensive development of the country. Agricultural sector is linked to other sectors for supplying agriculture with production requirements and services, in addition to using agricultural products as inputs in the industrial and services sectors. This led to developed Egyptian agricultural sector at rates that exceed the rates of population growth, which is necessary because of the importance of agricultural development in the overall economic and social development, and then the economic and political stability. The development of the agricultural sector is based on two axes, namely horizontal agricultural expansion through increasing the availability of economic resources by adding new lands, and the vertical expansion represented in raising the efficiency of using available agricultural economic resources using modern technological methods in Egyptian agriculture. Onions is cultivated in a large scale compared by other vegetable crops, as its exports come in the fifth rank after each of cotton, rice, potatoes, and oranges) (Shawky, 2006) in terms of its contribution in the monetary value of the total Egyptian agricultural exports, as the value of Egyptian onion exports represented about 3.82% of the total value of Egyptian agricultural exports during the period (2003-2018) (Central Agency for Public Mobilization and Statistics).

Research Problem

Despite of the economic and export significance of the onion crop in Egypt but the cultivated area of onion is still limited, in addition to fluctuating prices from year to year and the increase of the nutritional needs of the population, which led to promote the cultivation and production of onion crops to meet local needs and also achieve to a competitive advantage in global markets for providing foreign currencies that contribute in Egyptian economy development.

Research Objective

The research aims to estimate the supply response functions of onion crop in Egypt to determine the most important economic factors affecting the cultivated area of the onion crop, by identifying of current productive position of onion, identifying the economic variables affecting the farmer's response to expand the cultivated area of onion, investigating determinants of productive efficiency of onion, and examining the relationships between production inputs of onion and estimating supply response of the cultivated area to some variables related to other competing crops.

MATERIALS AND METHODS

The research adopted a quantitative and descriptive analysis depending on statistical estimation of the studied variables and estimating supply response functions by using the Mark Nerlove dynamic model as the most famous economic model in estimating the supply response functions for its easy estimation and the ability to enter many independent variables in the model (Elshoweikh *et al.,* 2015). The model depends on measuring the response of cultivated area of onions by using influencing variables such as prices, total costs, and net profit of other crops that compete with onion in cultivated area.

The response model used in the study can be expressed as follows (Mohan, 1989):

$$Y^*_t = \hat{\beta}_0 + \hat{\beta}_1 X_{1t-1} + \hat{\beta}_2 X_{2t-1} + \dots + \hat{\beta}_k X_{kt-1} + \mu^*_t \longrightarrow (1)$$

By using the description of "Nerlove Model" for partial modifying as follow:

$$(Y_t - Y_{t-1}) = \lambda (Y^*_t - Y_{t-1})$$

$$\therefore \quad Y_t = \lambda Y^*_t + (1-\lambda) Y_{t-1} \longrightarrow (2)$$

By substitute equation (1) in equation (2), for getting the following model:

$$Y_t = \beta_0 \lambda + \beta_1 \lambda X_{1t-1} + \beta_2 \lambda X_{2t-1} + \dots + \beta_k \lambda X_{kt-1} + (1-\lambda) Y_{t-1} + \lambda \mu_t \quad (3)$$

Where:

Y_t = Cultivated area of the crop in the present year t.

Y_t^* = Desired area to be cultivated of the crop in the present year t.

Y_{t-1} = Cultivated area of the crop in the previous year t-1.

$X_{1t-1} \dots X_{kt-1}$ = Explanatory variables in the previous year t-1.

By using Nerlove model conversions, supply response equation is obtained as in equation (3) from regression coefficients in equation (1):

$$\hat{\beta}_o = \beta_o \lambda / \lambda \quad . \quad \hat{\beta}_1 = \beta_1 \lambda / \lambda \quad . \quad \hat{\beta}_k = \beta_k \lambda / \lambda$$

So that the response factor is: $(1 - \lambda)$

Also the period time of total response is: $1/(1-\lambda)$

Short run elasticity (S.R.E) and long run elasticity (L.R.E.) can be estimated as follow:

$$S.E.R = \hat{B}\,(\overline{X}/\overline{Y}) \qquad L.R.E = S.R.E / (1-\lambda)$$

The study estimated supply response functions of onion by using the lagged distribution model aiming to identify the impact of the various economic variables for measuring the supply response of cultivated area according the reality of Egyptian agriculture to identify the most important factors affecting onions production in Egypt by estimating the response function of onions in Egypt (Elzanaty *et al.,* 2012), where it was assumed that: (1) Studying the response of cultivated area of onion in the current year is affected by some variables related to the onion crop by lagging of one year, represented in: productivity, farm price, total costs, and net profit. (2) Studying the response of the cultivated area of onion in the current year affected by some variables of crops competed onion such as wheat, broad beans, tomatoes, clover, garlic, sugar beet represented in: relative prices, relative costs - relative net profits.

The data sources based on published and unpublished data issued by several agencies, such as the Central Administration for Agricultural Economics at the Ministry of Agriculture and Land Reclamation, and the Central Agency for Public Mobilization and Statistics.

RESULTS AND DISCUSSION

Economic variables of the Egyptian onion

1. Cultivated area

Data in Table (1) show that the cultivated area of onion in Egypt during the period (2003-2018) is ranged between a minimum value about 59.36 thousand feddans in 2006, and a maximum value about 185.31 thousand feddans in 2018, with an average about 120.723 thousand feddans. The results of the estimating the time trend of the onion cultivated area, represented in equation (1) in Table (2), during the same period show a significant increase by 8 thousand feddans that represented about 6.63% of the average during the studied period. The determination coefficient was about 0.879 meaning that about 87.9% of the changes in the cultivated area of onion during the studied period due to the variables embedded in the time variable.

2. Productivity

Data in Table (1) indicated that the productivity of onion in Egypt during the period (2003-2018) is ranged between a minimum value about 11.76 ton/feddan in 2003, and a maximum value about 15.039 ton/feddan in 2018, with an average by 13.846

ton/feddan. The results of the estimation the productivity time trend equation shown in equation (2) in Table (2) implied that there is a significant increase, at a significant level 5%, by 0.18 ton/feddan represented about 13% during the studied period. In addition, the determination coefficient was about 0.825 meaning that about 82.5% of the changes in the productivity of onion during the studied period due to the variables that reflected coefficient of time.

3. Total production

Data in Table (1) implying that the total production of onion in Egypt during the period (2003-2018) is ranged between a minimum value about 752.5 tons in 2006, and a maximum value about 2729.24 tons in 2018, with an average about 1701.98 tons. The results of the production time trend analysis represented in equation (3) in Table (2) confirmed the significant and positive increase by 130.86 tons per year that represented about 7.69% during the studied period. The determination coefficient was about 0.909 meaning that about 90.9% of the changes in the total production of onion during the studied period due to the variables that embedded in the time variable**.**

Table (1): Economic variables of Egyptian onion crop during the period (2003-2018)

Year	Cultivated Area (thousand feddan)	Productivity (ton/feddan)	Farm price (L.E/ton)	total production (thousand ton)	Value of onion exports (million dollar)	Value of agricultural exports (million dollar)	% onion exports value to agricultural exports value
2003	64.187	11.760	228.398	754.856	33.007	937.745	3.520%
2004	69.161	12.948	315.001	895.491	36.491	1314.300	2.776%
2005	101.385	12.843	295.988	1302.125	31.003	1167.538	2.655%
2006	59.362	12.677	480.009	752.505	23.900	1086.375	2.200%
2007	80.371	13.280	603.002	1067.326	36.086	1563.409	2.308%
2008	101.598	13.674	658.976	1389.258	41.559	2176.839	1.909%
2009	115.295	13.560	706.982	1563.360	168.560	4406.997	3.825%
2010	125.397	13.811	755.030	1731.824	170.396	2918.006	5.839%
2011	123.487	14.259	839.978	1760.752	215.617	5093.656	4.233%
2012	129.083	14.347	858.016	1851.908	157.288	4140.772	3.799%
2013	117.178	14.971	875.978	1754.310	202.553	4867.292	4.162%
2014	152.539	15.039	959.027	2294.049	165.180	4354.060	3.794%
2015	183.916	14.637	1040.991	2691.919	270.377	4267.184	6.336%
2016	153.764	14.430	1051.984	2218.784	197.822	3953.085	5.004%
2017	169.535	14.579	1519.507	2474.013	206.486	4993.330	4.135%
2018	185.305	14.728	1998.024	2729.241	265.343	5644.143	4.701%
Average	120.723	13.846	824.181	1701.983	138.854	3305.296	3.820%

Source*:* (1) Calculated from the Central Agency for Public Mobilization and Statistics, the Information and Decision Support Center, the Foreign Trade Database (2) The Central Department of Agricultural Economics, Ministry of Agriculture

Table (2): General time trend equations for economic variables of the Egyptian onion crop during the period (2003-2018)

No of equation	Item	Equation	R^2	F	Change rate
1	**Cultivated Area (thousand feddan)**	$Y_t = 60.71 + 8\ X_t$ (8.67) (10.06)	0.879	101.27	6.63%
2	**Productivity (ton/feddan)**	$y_t = 12.49 + 0.18\ X_t$ (64.09) (8.13)	0.825	66.09	1.30%
3	**total production (thousand ton)**	$y_t = 720.57 + 130.86\ X_t$ (7.38) (11.8)	0.909	139.26	7.69%
4	**Farm price L.E/ton)**	$y_t = 165.91 + 9.93\ X_t$ (1.89) (8.83)	0.848	78.05	1.20%
5	**Value of exports (million dollar)**	$y_t = 12.37 + 16.87\ X_t$ (0.62) (7.5)	0.768	56.27	12.15%

Y_t = the estimated value of the studied phenomenon in year (t)
X_t = time factor , where t = 1,2,3,……
Number between brackets is t- calculated value
***Source**:* Calculated and calculated from data of the Central Department of Agricultural Economics, Ministry of Agriculture

4. Farm price

Data in Table (1) show that the farm price of onion in Egypt during the period (2003-2018) is ranged between a minimum value about 228.39L.E/ton in 2003, and a maximum value about 1998.02L.E/ton in 2018, with an average of 824.18 L.E/ton. As it shown in Table (2), the equation of time trend of the evolution of the farm price of onion during the same period which is described by equation (4) statistically confirmed the increasing of farm price at a significant level 5%. The increasing rate was about 9.93 L.E/ton/year that represented about 1.2% during the studied period. On the other hand, the determination coefficient was about 0.848 meaning that about 84.8% of the changes in the farm price of onion during the studied period due to the variables that reflected coefficient of time.

5. Value of Egyptian onion exports

Data in Table (1) represents the value of Egyptian onion exports during the period (2003-2018) that is ranged between a minimum value about 23.9 million dollars in 2006 that represented 2.2% of the value of Egyptian agricultural exports, and a maximum value about 270.38 million dollars that represented 6.34% of the value of Egyptian agricultural exports in 2015, with an average of 138.85 million dollars that represented 3.82% of the value of Egyptian agricultural exports. The results of the estimation of time trend analysis for the value of Egyptian onion exports during the same period in equation (5) implied that there is a significant increase rate by about 16.87 million dollars/year that represented about 12.15% during the studied period. Moreover, the determination coefficient was about 0.768 meaning that about 76.8% of the changes in value of Egyptian onion exports during the studied period due to the variables that reflected coefficient of time.

Financial indicators of Onion Production in Egypt

1. **Total revenue**: Data in Table (3) showed the total revenue of onion in Egypt during the period (2003 - 2018) is ranged between a minimum value about 2.724 thousand L.E/feddan in 2003 and a maximum value about 29.317 thousand L.E/feddan in 2018 by increasing rate 90.71% over the minimum value, with an average of 11.771 thousand L.E/feddan.

2. **Total costs**: Data in Table (3) showed that the total costs of onion in Egypt during the period (2003-2018) is ranged between a minimum value about 2.206 thousand L.E/feddan in 2003, and a maximum value about 10.949 thousand L.E/feddan in 2018 by increasing rate 79.85% over the minimum value, with an average of 4.101 thousand L.E/feddan.

3. Net profit: Data in Table (3) showed the net profit of onion in Egypt during the period (2003-2018) is ranged between a minimum value about 517.7 thousand L.E/feddan in 2003 and a maximum value about 18.368 thousand L.E/feddan in 2018 by increasing rate 97.19% over the minimum value, with an average of 7.670 thousand L.E/feddan.

Table (3): Financial indicators of onion production in Egypt during period (2003-2018)

Year	Total revenue (L.E)	total cost (L.E)	(1) net profit (L.E)	(2) revenue/ cost ratio	(3) revenue of invested pound (L.E)	(4) profit of production unit (L.E/ton)
2003	2724.1	2206.4	517.7	1.235	0.235	44.022
2004	4141	2486	1655	1.666	0.666	127.819
2005	3836	2632	1204	1.457	0.457	93.748
2006	6171	2791	3380	2.211	1.211	266.625
2007	8114	2827	5287	2.870	1.870	398.117
2008	9140	3040	6100	3.007	2.007	446.102
2009	9680	3290	6390	2.942	1.942	471.251
2010	10507	3438	7069	3.056	2.056	511.848
2011	12031	3637	8394	3.308	2.308	588.697
2012	12352	3612	8740	3.420	2.420	609.202
2013	13208	3767	9441	3.506	2.506	630.605
2014	14512	4090	10422	3.548	2.548	692.994
2015	15212	4397	10815	3.460	2.460	738.897
2016	15137	4788	10349	3.161	2.161	717.196
2017	22264.5	7673	14591.5	2.902	1.902	1000.851
2018	29317	10949	18368	2.678	1.678	1247.117
Average	11771.663	4101.463	7670.200	2.777	1.777	536.568

(1) Net profit = total revenue – total cost
(2) Revenue/cost ratio = total revenue/total cost
(3) Revenue of invested pound = 1- revenue/cost ratio
(4) Profit of production unit = Net profit/productivity
***Source**:* The Central Department of Agricultural Economics, Ministry of Agriculture

4. **Total revenue/Total cost ratio**: Data in Table (3) showed the revenue/cost ratio of onion in Egypt during the period (2003-2018) that is ranged between a minimum value about 1.235 in 2003, and a maximum value about 3.548 in 2014 by increasing rate 65.2% over the minimum value, with an average is estimated about 2.777.

5. **Revenue of invested pound**: Data in the same Table showed that the revenue of invested pound of onion in Egypt during the period (2003-2018) is ranged between a minimum value about 0.235 L.E for every invested pound in 2003, and a maximum value about 2.548 L.E for every invested pound in 2014 by increasing rate 90.79% over the minimum value, with an average is estimated about 1.777 L.E for every invested pound.

6. Profit of the production unit: Data in Table (3) showed the profit the production unit of onion in Egypt during the period (2003-2018) is ranged between a minimum value about 44.02 L.E/ton in 2003, and a maximum value about 1.274 thousand L.E/ton in 2018 by increasing rate 96.49% over the minimum value, with an average is estimated about 536.57 L.E/feddan.

Supply response functions by using variables related to onion crop

Results in Table (4) shows the supply response functions of onion by using the dynamic Nerlove model. Equation (1) estimated the farmer's response to the productivity of onions in the previous year, as the determination coefficient about 82.3% of the changes in cultivated area of onion are due to the productivity of onion in the previous year, and the rest of other changes are due to other variables not present in the function. The significance of the model was statistically proven at the level of 0.01 as the value of F ratio is 27.89. The results show that increasing the productivity of the onion in the previous year by one ton lead to an increase in the cultivated area of onions in the current year by about 26.75 thousand feddans, assuming that other

factors remain constant at a certain level. The supply response elasticity of onion reached about 4.07 and 5,735 in the short run and long run, respectively. Such result implied that the increase of onion productivity in the previous year by 1% leads to an increase in the cultivated area of the onion in the current year by 4.07% and 5.73% in the short run and long run, respectively.

Equation (2) estimated the farmer's response to the farm price of onion in the previous year. The determination coefficient indicated that 83.4% of the changes in cultivated area of onion are due to the farm price of onion in the previous year, and the rest of other changes are due to other variables not present in the function. The significance of the model was statistically proven at the level of 0.01 as the value of F ratio is 30.09. The results show that increasing the farm price of onion in the previous year by one pound lead to an increase in the cultivated area of onions in the current year by about 90 feddans, assuming that other factors remain constant at a certain level. The supply response elasticity of onion reached about 0.536 and 0.661 in the short run and long run, respectively concluding that the increase of onion farm price in the previous year by 1% leads to an increase in the cultivated area of the onion in the current year by 0.536% and 0.661% in the short run and long run, respectively.

Equation (3) estimated the farmer's response to the total production costs of onion in the previous year. The determination coefficient indicating that 78.2% of the changes in cultivated area of onion are due to the total production costs of onion in the previous year, and the rest of other changes are due to other variables not present in the function. The significance of the model was statistically proven at the level of 0.01 as the value of F ratio is 21.56. The results show that increasing the total production costs of onion in the previous year by one pound lead to an increase in the cultivated area of onions in the current year by about 20 feddans. The supply response elasticity of onion reached about 0.852 and 1.39 in the short run and long run respectively, and this shows that the increase of total cost production of onion in the previous year by 1% leads to an increase in the cultivated area of the onion in the current year by 0.852% and 1.39% in the short run and long run, respectively.

Table (4): Supply response functions of onion according to productivity, farm price, total cost and net profit during period (2003-2018)

no	Item	Equation	R^2	F	Yearly response factor	Total response period	Short run elasticity	Long run elasticity
1	**Productivity (ton/feddan)**	yt= -279.26 + 0.29 y(t-1) + 26.75 X1(t-1) (-2.64) (1.31) (2.90)	0.823	27.89	0.71	1.408	4.072	5.735
2	**Farm price (L.E/feddan)**	yt= 38.51 +0.19 y(t-1) + 0.09 X2(t-1) (2.50) (0.76) (3.12)	0.834	30.09	0.81	1.235	0.536	0.661
3	**Total cost (L.E/FED)**	yt= 13.13 + 0.39 y(t-1) + 0.02 X3(t-1) (0.74) (1.56) (2.14)	0.782	21.56	0.61	1.639	0.852	1.396
4	**Net profit (L.E/fed)**	yt= 58.82 + 0.05 y(t-1) + 0.009 X4(t-1) (3.77) (0.21) (3.78)	0.87	40.21	0.95	1.053	0.248	0.261

Y_t = cultivated area of onion in current year (thousand feddan)
$Y_{(t-1)}$= cultivated area of onion in the previous year (thousand feddan)
$X_{1(t-1)}$= productivity of onion in the previous year (Ton/feddan)
$X_{2(t-1)}$ = farm price of onion in the previous year (L.E/feddan)
$X_{3(t-1)}$ = Total cost of onion in the previous year (L.E/feddan)
$X_{4(t-1)}$ = Net profit of onion in the previous year (L.E/feddan)
Source: calculated from data of the central department of agricultural economics, Ministry of Agriculture

Equation (4) estimated the farmer's response to the net profit of onion in the previous year, as the determination coefficient about 87% of the changes in cultivated area of onion are due to the net profit of onion in the previous year, and the rest of other changes are due to other variables not present in the function. The significance of the model was statistically proven at the level of 0.01 as the value of F ratio is 40.21. The results show that increasing the net profit of onion in the previous year by one pound lead to an increase in the cultivated area of onions in the current year by about 9 feddans, assuming that other factors remain constant at a certain level. The supply response elasticity of onion reached about 0.248 and 0.26 in the short run and long run respectively, and this shows that the increase of net profit of onion in the previous year by 1% leads to an increase in the cultivated area of the onion in the current year by 0.248% and 0.26% in the short run and long run, respectively.

Supply response functions to onion competitive crops variables

1. Relative costs

Table (5) shows that the most important variables affecting the cultivated area of onions in the current year are the ratio of average production cost between onion and the following crops: wheat, broad beans, clover, tomatoes, sugar beets and garlic in the previous year. The significance of the model was statistically proven at the level of 0.01, where the value of F-ratio was 15.56. Also there was no auto-correlation problem as the calculated value of the Durbin - Watson test = 2.78. The determination coefficient indicates that 93.9% of the changes of the cultivated area of onions in the current year are due to the variables in the model, and the rest of the changes are due to other variables that were not included in the model.

Also data in Table (5) shows the significance of the relationship between the response of cultivated area of the onion in the current year and the ratio of average production cost between onion and garlic in the previous year, therefore the increase in the ratio of average production cost between onion and garlic by 1%, lead to increases the cultivated area of onions by 1.92% and 1.48% in the short run and long run, respectively, which represent 2.39 thousand feddans and 1.85 thousand feddans, respectively. Perhaps the reason of illogic sign of this variable is due to the competition between garlic and onion on the cultivated area, but farmers preferred to planting onion, keeping in their minds costs of competitive crops but onion achieves a higher profitability than garlic (Mekdad, 2016). In addition data in Table (5) shows the significance of the relationship between the cultivated area of the onion crop in the current year and the ratio of average production cost between onion and wheat in the previous year, therefore the increase in the ratio of average production cost between onion and wheat by 1%, lead to decreases the cultivated area of onions by 4.29% and 3.33% in the short run and long run respectively, which represent 5.34 thousand feddans and 4.14 thousand feddans, respectively.

Table (5): Supply response functions of onion to the total cost ratio of the most important crops compete with onion in the previous year during period (2003-2018).

Item	Coefficients	t Stat	Short run Elasticity	Cultivated area response (thousand fed)	Long run elasticity	Cultivated area response (thousand fed)
Constant	189.0757	1.08				
Y_t	-0.29004	-1.00				
X1(t-1)	-729.854	-2.31	-4.29	5.341	-3.325	4.140
X2(t-1)	148.6261	0.89	0.92	1.145	0.713	0.888
X3(t-1)	-20.1484	-0.17	-0.202	0.251	-0.157	0.195
X4(t-1)	115.1355	0.44	0.52	0.647	0.403	0.502
X5(t-1)	133.4019	1.11	0.89	1.108	0.690	0.859
X6(t-1)	437.02	2.21	1.92	2.390	1.488	1.853
Yearly response factor	1.290					
Total response period	0.775					
DW	2.78					
Fc	15.57					
R^2	0.9396					

Y_t=Cultivated area of onion in current year (thousand fed)
$x1_{(t-1)}$=Total cost of onion/Total cost of wheat in previous year (L.E/fed)
$x2_{(t-1)}$=Total cost of onion/Total cost of broad bean in previous year (L.E/fed)
$x3_{(t-1)}$=Total cost of onion/Total cost of clover in previous year (L.E/fed)
$x4_{(t-1)}$= Total cost of onion/Total cost of tomato in previous year (L.E/fed)
$x5_{(t-1)}$ = Total cost of onion/Total cost of sugar beet in previous year (L.E/fed)
$x6_{(t-1)}$= Total cost of onion/Total cost of garlic in previous year (L.E/fed)
Source: calculated from data of the central department of agricultural economics, Ministry of agriculture.

2. Net profit

Table (6) shows that the most important variables affecting the cultivated area of onions in the current year are the ratio of net profit per feddan between onion and the following crops: wheat, broad beans, clover, tomatoes, sugar beets and garlic in the previous year. The significance of the model was statistically proven at the level of 0.01, where the value of F-ratio was 11.42. There was no auto-correlation problem as the calculated value of the Durbin - Watson test = 2.5. The determination coefficient indicates that 91.95% of the change of the cultivated area of onions in the current year is due to the variables in the model, and the rest of the changes are due to other variables that were not included in the model.

Table (6): Supply response functions of onion by using net profit ratio of the most important crops compete in the previous year during period (2003-2018)

Item	Coefficients	t Stat	Short run Elasticity	Cultivated area response (thousand fed)	Long run elasticity	Cultivated area response (thousand fed)
Constant	47.639	2.353				
Y	-0.244	-0.810				
$X1_{(t-1)}$	14.678	1.656	0.268	0.334	0.215	0.268
$X2_{(t-1)}$	14.395	2.397	0.381	0.474	0.306	0.381
$X3_{(t-1)}$	-125.276	-2.579	-0.862	-1.073	-0.693	-0.863
$X4_{(t-1)}$	55.855	1.236	0.217	0.270	0.174	0.217
$X5_{(t-1)}$	26.652	2.133	0.435	0.542	0.350	0.435
$X6_{(t-1)}$	69.855	3.005	0.407	0.507	0.327	0.407
yearly response factor	1.244					
total response period	0.804					
DW	2.503					
Fc	11.42					
R^2	0.9195					

Y_t= Cultivated area of onion in current year (thousand fed).
$x1_{(t-1)}$= Net profit of onion / Net profit of wheat in previous year (L.E/fed).
$x2_{(t-1)}$ = Net profit of onion / Net profit of broad bean in previous year (L.E/fed).
$x3_{(t-1)}$= Net profit of onion / Net profit of clover in previous year (L.E/fed).
$x4_{(t-1)}$ = Net profit of onion / Net profit of tomato in previous year (L.E/fed).
$x5_{(t-1)}$ = Net profit of onion / Net profit of sugar beet in previous year (L.E/fed).
$x6_{(t-1)}$= Net profit of onion / Net profit of garlic in previous year (L.E/fed).
Source: calculated from data of the central dapartment of agricultural economics, Ministry of Agriculture.

Data in Table (6) shows the significance of the relationship between the response of cultivated area of the onion in the current year and the ratio of net profit per feddan between onion and clover in the previous year, therefore the increase in the ratio of net profit per feddan between onion and clover by 1%, lead to decrease the cultivated area of onions by 0.862% and 0.693% in the short run and long run, respectively, which represent 1.703 thousand feddans and 0.863 thousand feddans, respectively. Perhaps the reason for the illogical reference to this variable is that the alfalfa crop is considered as an essential food for animals, as clover cultivation are preferred to meet the animals' need for food, in addition clover is cheaper than concentrated fodder and more useful than it. Also the ratio of net profit per feddan between onion and clover has a decreasing trend over time because net profit of clover is higher than net profit of onion.

In addition, data in Table (6) shows the significance of the relationship between the cultivated area of onion in the current year and the ratio of net profit per feddan between onion and wheat in the previous year, therefore the increase in the ratio between net of net profit per feddan between onion and wheat by 1%, lead to increases the cultivated area of onions by 0.381% and 0.306% in the short run and long

run respectively, which represent 0.474 thousand feddans and 0.381 thousand feddans respectively. Also data in Table (6) shows the significance of the relationship between the cultivated area of onion in the current year and the ratio of net profit per feddan between onion and garlic in the previous year, therefore the increase in the ratio of net profit per feddan between onion and garlic by 1%, lead to increases the cultivated area of onions by 0.407% and 0.327% in the short run and long run respectively, which represent 0.507 thousand feddans and 0.407 thousand feddans respectively. Data in the same Table shows the significance of the relationship between the cultivated area of onion in the current year and the ratio of net profit per feddan between onion and sugar beet in the previous year, therefore the increase in the ratio of net profit per feddan between onion and sugar beet by 1%, lead to increases the cultivated area of onions by 0.435% and 0.35% in the short run and long run respectively, which represent 0.542 thousand feddans and 0.435 thousand feddans respectively.

CONCLUSION AND RECOMMENDATIONS

Despite of economic and export significance of onion crop, also Egypt enjoying many of ingredients that are necessary for its production, but cultivated area of onion is still limited, in addition to fluctuating prices from year to year and the increase of the nutritional needs of the population, which led to promote the cultivation and production of onion crops to meet local needs and also achieve to a competitive advantage in global markets for the provision of foreign currencies that contribute in Egyptian economy development. The research aims to estimate the supply response functions of onion crop in Egypt to determine the most important economic factors affecting the cultivated area of the onion crop, by identifying of current productive position of onion - identifying of economic variables affecting the farmer's response to the expansion of the cultivated area of onion - Studying of the most important determinants of productive efficiency of onion - Studying the current relationships between production inputs of onion and estimating supply response of variables of some competing crop. So that The most important results has been reached: 1-Average of total revenue of onion is estimated about 11.771 thousand L.E/feddan during the period (2003-2018), also average of total production cost of onion is estimated about 4.101 thousand L.E/feddan, so that average of net profit per feddan of onion is estimated about 7.670 thousand L.E/feddan during the same period. 2- Increasing of onion productivity in the previous year by 1% leads to an increase in the cultivated area of the onion in the current year by 4.07% and 5.73% in the short run and long run, respectively. 3- Increasing of farm price of onion in the previous year by one pound lead to an increase in the cultivated area of onions in the current year by about 90 feddans, assuming that other factors remain constant at a certain level. 4- Increasing of total cost production of onion in the previous year by 1% leads to an increase in the cultivated area of the onion in the current year by 0.852% and 1.39% in the short run and long run, respectively.5-Increasing the net profit of onion in the previous year by one pound lead to an increase in the cultivated area of onions in the current year by about 9 feddans, assuming that other factors remain constant at a certain level.

Most important recommendations that can be summarized as follows: 1- Setting an appropriate price policy for the requirements of onion production to reduce production costs, increases the net profit, and encourages its cultivation. 2- Adopting a general strategy to modernize agricultural methods and technological devices that is compatible with the Egyptian conditions to reach production and productivity to the highest possible levels. 3- Increase the productivity per feddan of onion, which is a reflection of the technological progress in onion cultivation, in addition to activating the role of agricultural extension to improve the productivity of this crop. 4- Supporting production of inputs such as fertilizers and seeds, providing machines and means of transporting so that farmers can increase production while working to find scientific solutions for production and marketing problems.

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استجابة عرض محصول البصل في جمهورية مصر العربية

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يعتبر البصل أحد أهم محاصيل الخضر في مصر نظرا لزراعته على نطاق واسع بالمقارنة بمحاصيل الخضر الأخرى، وفضلا عن أهميته كمحصول غذائي هام فإنة يأتي في المرتبة الخامسة بعد كل من (القطن - الأرز- البطاطس - البرتقال) من حيث إسهامه في القيمة النقدية لإجمالي الصادرات الزراعية المصرية، وتمثل قيمة صادرات مصر من البصل نحو ٣.٨٢% من إجمالي قيمة الصادرات المصرية الزراعية وذلك خلال الفترة (٢٠٠٣- ٢٠١٨). وعلي الرغم من الأهمية الاقتصادية والتصديرية لمحصول البصل ومع تمتع مصر بالعديد من المقومات اللازمة لإنتاجه إلا أن الرقعة المزروعة به مازالت محدودة هذا إلي جانب تذبذب أسعاره من عام لآخر بالإضافة إلي زيادة الاحتياجات الغذائية للسكان. مما أدي إلي أهمية وضرورة النهوض بزراعة وإنتاج محصول البصل لسد الاحتياجات المحلية وأيضا تحقيق ميزة تنافسية في الأسواق العالمية لتوفير العملات الأجنبية والتي تسهم في تنمية الاقتصاد المصري. لذا استهدف البحث إلي تقدير دوال استجابة العرض لمحصول البصل في جمهورية مصر العربية باستخدام نموذج مارك نيرلوف الديناميكي باعتباره اشهر النماذج الاقتصادية في تقدير دوال استجابة العرض لسهولة تقديره وإمكانية إدخال العديد من المتغيرات المستقلة في تلك الدالة لتحديد أهم العوامل الاقتصادية المؤثرة علي المساحة المزروعة لمحصول البصل. وتناولت الدراسة تقدير دوال استجابة العرض لمحصول البصل باستخدام نموذج التوزيع المتأخر وذلك بهدف إلقاء الضوء علي أثر المتغيرات الاقتصادية المختلفة التي يتناولها النموذج علي استجابة عرض المساحة المزروعة وكذلك إظهار أفضل النماذج تأثيراً علي استجابة المحصول وبما يتماشى مع واقع الزراعة المصرية للتعرف علي أهم العوامل المؤثرة علي إنتاج البصل في مصر من خلال تقدير دالة استجابة عرض البصل في مصر حيث افترض أن: مساحة المحصول في العام الحالي تتأثر ببعض المتغيرات المرتبطة بالمحصول بفترة تأخير عام واحد متمثلة في الإنتاجية الفدانية - السعر المزرعي - التكاليف الكلية وصافي العائد الفداني، ودراسة استجابة عرض مساحة المحصول في العام الحالي من خلال تأثرها ببعض متغيرات المحاصيل المنافسة (القمح - الفول البلدي - الطماطم - البرسيم البلدي - الثوم - بنجر السكر) متمثلة في: الأسعار النسبية - التكاليف النسبية صافي العائد النسبي. ومن النتائج الهامة التي تم التوصل إليها أن المتوسط العام للعائد الكلي لمحصول البصل خلال الفترة (٢٠٠٣-٢٠١٨) نحو ١١.٧٧١ ألف جنية/فدان، بينما بلغ المتوسط العام للتكاليف الكلية لمحصول البصل خلال تلك الفترة نحو ٤.١٠١ ألف جنية/فدان، وهذا يعني أن المتوسط العام لصافي العائد لمحصول البصل خلال تلك الفترة نحو ٧.٦٧٠ ألف جنية/فدان. كما أن زيادة إنتاجية محصول البصل في العام السابق بطن واحد يترتب عليه زيادة المساحة المزروعة بالبصل في العام الحالي بنحو ٢٦.٧٥ ألف فدان مع افتراض ثبات العوامل الأخرى عند مستوي معين، كما بلغت مرونة استجابة العرض لمحصول البصل نحو ٤.٠٧ وهذا يوضح أن زيادة إنتاجية محصول البصل في العام السابق بنسبة ١% تؤدي إلي زيادة المساحة المزروعة من محصول البصل في العام الحالي بنحو ٤.٠٧٪.