Costs Analysis of Maize Production in Egypt

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ABSTRACT

The study has focused on analyze the costs of maize production in Egypt during the time period 2000-2012. The study applies the ordinary least squares technique to estimate the parameters of the regression equation. The results indicate that the fertilizers cost, labor wages and machinery cost are significant in maize production in Egypt.

INTRODUCTION

Maize is one of the most important cereal crops in the world, which occupies second in terms of grain production in world after wheat and rice. Those three crops are the main source of energy in human food, and can be planted in most temperate and tropical regions in the world. The major producing countries of maize are USA, Brazil, China, Mexico, Romania, France and Indonesia. Maize is considering important crop in Egypt due to its importance in human nutrition, animal and poultry nutrition, also maize intervene in some industries such as extraction of glucose, fructose and oil (Solieman, *et al.,* 2015).

Problem and Objective of the Study

Despite the importance of maize crop in Egypt, there is a high increasing in its production costs during the time period (2000-2012), this study aims to analyze the costs of maize production in Egypt during the time period (2000-2012).

Methodology

The ordinary least squares technique is used to estimate the parameters of the regression equation. The ordinary least squares technique is most appropriate because the parameters estimates have the highly desirable properties of being best, linear, and unbiased estimators if a number of underlying assumptions are not violated. To examine the input-output relationship a Cobb-Douglas production function was employed. The Cobb-Douglas production function is simple functional form, convenient to use, reflects actual input-output relationship, and easy to estimate and interpret. We can express the model as the following:

$$Y_i = \beta_1 + \beta_2 x_i + u_i, \ i = 1, 2, \ldots n, \ \textbf{where } Y_i$$

is the production, X_i is the input, β is a vector of parameter to be estimated; u_i is the error. The logarithmic transformation of the Cobb-Douglas production function has been widely used because of its convenience in interpretation (Abu Samah and Suandi 1999). The Cobb-Douglas production function can be reduced to the following form;

$$Y = \beta_0 + \beta_1 \ln x_1 + \beta_2 \ln x_2 + \beta_3 \ln x_3 + \beta_4 \ln x_4 + \beta_5 \ln x_5 + \beta_6 \ln x_6 + u$$

where Y is the costs of maize production in Egypt during the time period (2000-2012), while X_1 is labor wages, X_2 is machinery cost, X_3 is seeds cost, X_4 is manure cost, X_5 is fertilizers cost and X_6 is

insecticides cost. β is a vector of parameter to be estimated and u is the error.

Data and Results

Table (1) shows the production, area and yield of maize in Egypt during the time period (2000-2012). The minimum value of production is 842.84 thousand ton in 2009, while the maximum value of production is 7205.54 thousand ton in 2012. The mean of production for the time period (2000-2012) is 4914.14 thousand ton and the rate is 2.05%. The minimum value of area is 262.55 thousand feddan in 2009, while the maximum value of area is 2157.08 thousand feddan in 2012. The mean of area for the time period (2000-2012) is 1418.69 thousand feddan and the rate is 2.11%. The minimum value of yield is 2.96 ton/feddan in 2010 while the maximum value of yield is 3.88 ton/feddan in 2007. The mean of yield for the time period (2000-2012) is 3.46 ton/feddan and the rate is declining -0.06%.

Table 1. Production, Area and Yield of Maize in Egypt ((2000-2012)).

Year	Production (Thousand Ton)	Area (Thousand Feddan)	Yield (Ton/Feddan)
2000	5650.37	1679.45	3.36
2001	6093.58	1773.45	3.44
2002	5676.45	1668.49	3.40
2003	5681.78	1657.80	3.43
2004	5839.93	1684.92	3.47
2005	6866.53	1940.26	3.54
2006	5708.17	1566.47	3.64
2007	6243.22	1608.37	3.88
2008	6306.05	1860.36	3.39
2009	842.84	262.55	3.21
2010	911.00	307.47	2.96
2011	858.32	276.35	3.11
2012	7205.54	2157.08	3.34
Mean	4914.14	1418.69	3.46
Rate[a]	2.05	2.11	-0.06

Sources: FAOSTAT, MALR in Egypt and own elaboration

[a] Annual average percentage growth rate ((2000-2012))

Table (2) shows the maize production in the main governorates in Egypt during the time period (2000-2012). In 2000 the minimum value of production is 106.83 thousand ton in Ismailia, while the maximum value of production is 889.62 thousand ton in Menia. In 2012 the minimum value of production is 118.95 thousand ton in Ismailia, while the maximum value of production is 944.19 thousand ton in Menia. The mean of production at the main governorates in Egypt in 2000

is 362.31 thousand ton and 456.18 thousand ton in 2012. Annual average percentage growth rate for the time period (2000-2012) is 2.11%.

Table 2. Maize Production in the Main Governorates in Egypt ((2000-2012)).

Governorate	Production (Thousand ton)		Production Rate[a]
	2000	2012	
Behairah	453.29	840.63	5.28
Gharbia	255.02	222.00	-1.15
Kafr Elshikh	208.22	291.50	2.84
Dakahlia	198.98	231.76	1.28
Sharkia	695.01	863.10	1.83
Ismailia	106.83	118.95	0.90
Menoufia	825.29	809.87	-0.16
Qalyoubia	308.05	250.11	-1.72
Giza	225.23	231.33	0.22
Beni Suef	318.69	497.47	3.78
Fayoum	124.05	273.07	6.80
Menia	889.62	944.19	0.50
Assuit	266.38	500.98	5.40
Suhag	374.08	475.88	2.03
Noubaria	185.87	291.00	3.81
Mean	362.31	456.18	2.11

Sources: MALR in Egypt and own elaboration

[a] Annual average percentage growth rate ((2000-2012))

Table (3) shows the maize area in the main governorates in Egypt during the time period (2000-2012). In 2000 the minimum value of area is 34.12 thousand feddan in Ismailia, while the maximum value of area is 266.78 thousand feddan in Menia. In 2012 the minimum value of area is 36.30 thousand feddan in Ismailia, while the maximum value of area is 292.88 thousand feddan in Menia.

Table 3. Maize Area in the Main Governorates in Egypt ((2000-2012)).

Governorate	Area (Thousand Feddan)		Area Rate[a]
	2000	2012	
Behairah	123.13	224.16	5.12
Gharbia	72.91	64.14	-1.06
Kafr Elshikh	60.54	79.91	2.34
Dakahlia	56.44	57.87	0.21
Sharkia	202.06	252.46	1.87
Ismailia	34.12	36.30	0.52
Menoufia	225.14	213.99	-0.42
Qalyoubia	85.68	73.15	-1.31
Giza	62.61	64.26	0.22
Beni Suef	114.15	178.68	3.80
Fayoum	40.36	98.39	7.71
Menia	266.78	292.88	0.78
Assuit	84.22	159.27	5.45
Suhag	114.01	140.14	1.73
Noubaria	58.53	80.56	2.70
Mean	106.71	134.41	1.98

Sources: MALR in Egypt and own elaboration   [a] Annual average percentage growth rate ((2000-2012))

The mean of area at the main governorates in Egypt in 2000 is 106.71 thousand feddan and 134.41 thousand feddan in 2012. Annual average percentage growth rate for the time period (2000-2012) is 1.98%.

Table (4) shows the maize yield in the main governorates in Egypt during the time period (2000-2012). In 2000 the minimum value of yield is 2.79 ton/feddan in Beni Suef, while the maximum value of yield is 3.68 ton/feddan in Behairah. In 2012 the minimum value of yield is 2.78 ton/feddan in Beni Suef and Fayoum, while the maximum value of yield is 4.00 ton/feddan in Dakahlia. The mean of yield at the main governorates in Egypt in 2000 is 3.36 ton/feddan and 3.42 ton/feddan in 2012. Annual average percentage growth rate for the time period (2000-2012) is 0.13%.

Table 4. Maize Yield in the Main Governorates in Egypt ((2000-2012)).

Governorate	Yield (Ton/Feddan)		Yield Rate[a]
	2000	2012	
Behairah	3.68	3.75	0.15
Gharbia	3.50	3.46	-0.09
Kafr Elshikh	3.44	3.65	0.49
Dakahlia	3.53	4.00	1.07
Sharkia	3.44	3.42	-0.04
Ismailia	3.13	3.28	0.38
Menoufia	3.67	3.78	0.27
Qalyoubia	3.60	3.42	-0.42
Giza	3.60	3.60	0.01
Beni Suef	2.79	2.78	-0.02
Fayoum	3.07	2.78	-0.85
Menia	3.33	3.22	-0.28
Assuit	3.16	3.15	-0.05
Suhag	3.28	3.40	0.29
Noubaria	3.18	3.61	1.08
Mean	3.36	3.42	0.13

Sources: MALR in Egypt and own elaboration

[a] Annual average percentage growth rate ((2000-2012))

Table (5) shows the total cost and production inputs costs (L.E./Feddan) of Maize in Egypt during the time period (2000-2012). The minimum value of total cost is 2735.40 L.E./Feddan in 2000 while the maximum value of total cost is 7865 L.E./Feddan in 2012. The mean of total cost for the time period (2000-2012) is 4786.65 L.E./Feddan and the annual average percentage growth rate is 9.20%. Table (5) and table (6) show the different inputs costs of maize production in Egypt during (2000-2012). The labor wages has the highest annual average percentage growth rate which is 11.04%, while the insecticides has the lowest annual average percentage growth rate which is 4.06%. Table (7) shows the results of analysis for the maize production inputs costs in Egypt during the time period (2000-2012). The coefficient of determination (R^2) =0.999, this indicates that about 99.9 % of the variance in the maize production costs is explained by the labor wages, machinery cost, seeds cost, manure cost, fertilizers cost, and insecticides cost. The value of Durbin-Watson at the level of significance 1% equal 2.497 this value is above the upper limit (2.490), conclude that there is no autocorrelation between the independent variables.

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Table 5. Total Cost and Production Inputs Costs (L.E./Feddan) of Maize in Egypt ((2000-2012)).

Year	Total Cost	Labor Wages	Machinery	Seeds Cost
2000	2735.40	621.70	353.80	183.10
2001	2756.10	635.00	346.60	175.30
2002	2812.00	680.00	346.00	178.00
2003	3256.00	800.00	372.00	198.00
2004	3486.00	829.00	388.00	231.00
2005	3823.00	933.00	413.00	271.00
2006	4026.00	960.00	421.00	283.00
2007	4739.00	1141.00	470.00	294.00
2008	6196.00	1474.00	553.00	331.00
2009	6195.00	1558.00	589.00	310.00
2010	6888.00	1874.00	682.00	340.00
2011	7449.00	2175.00	724.00	411.00
2012	7865.00	2185.00	902.00	470.00
Mean	4786.65	1220.44	504.65	282.72
Rate[a]	9.20	11.04	8.11	8.17

Sources: MALR in Egypt and own elaboration

[a] Annual average percentage growth rate ((2000-2012))

The value of F-Statistic equal 1106.744 this value more than the value of F-tab (8.47), since F- statistic higher than F-tab, conclude that the regression model fits the data at 1 % level of significance, and the labor wages, machinery cost, seeds cost, manure cost, fertilizers cost, and insecticides cost affects the maize production costs. The labor wages are significant at the level of 5%.

Table 6. Maize Production Inputs Costs (L.E./Feddan) in Egypt ((2000-2012)).

Year	Manure	Fertilizers	Insecticides
2000	125.40	309.00	60.80
2001	145.80	319.70	66.90
2002	126.00	317.00	55.00
2003	159.00	396.00	68.00
2004	178.00	474.00	52.00
2005	212.00	484.00	75.00
2006	264.00	505.00	61.00
2007	255.00	694.00	86.00
2008	289.00	967.00	93.00
2009	274.00	851.00	112.00
2010	310.00	942.00	130.00
2011	314.00	937.00	114.00
2012	337.00	932.00	98.00
Mean	229.94	625.21	82.44
Rate[a]	8.57	9.64	4.06

Sources: MALR in Egypt and own elaboration

[a] Annual average percentage growth rate ((2000-2012))

The regression coefficient of this variable equal 0.33 this result indicates that 1 percent increase in labor wages resulted in an increase in the maize production costs by 0.33 percent. The machinery cost is significant at the level of 5%. The regression coefficient of this variable equal 0.25 this result indicates that 1 percent increase in the machinery cost resulted in an increase in

the maize production costs by 0.25 percent. The seeds cost, manure cost and insecticides cost are not significant, conclude that there is no impact from the seeds cost, manure cost and insecticides cost on the maize production costs, this may be due to that the farmer can get the seeds from the last season without the need to buy it, the farmer also can get the manure from his farm without the need to buy, some farmers apply the program of integrated pest management without the need to use the insecticides. The fertilizers cost is significant at the level of 1%. The regression coefficient of this variable equal 0.32 this result indicates that 1 percent increase in fertilizers cost resulted in an increase in the maize production costs by 0.32 percent.

Table 7. Results of Analysis for Maize Production Costs in Egypt ((2000-2012)).

Variable	Coefficient	Std. Error	t-Statistic
Constant	2.12	0.15	14.27
X1	0.33	0.10	3.25
X2	0.25	0.10	2.54
X3	0.01	0.11	0.06
X4	0.05	0.74	0.69
X5	0.32	0.55	5.74
X6	0.02	0.05	0.46

R^2 = 0.999
Durbin-Watson = 2.497
F-Statistic = 1106.744
F-tab (1%) = 8.47

Source: Own elaboration

CONCLUSION AND RECOMMENDATION

Maize is considering important crop in Egypt due to its importance in human nutrition, animal and poultry nutrition, also maize intervene in some industries such as extraction of glucose, fructose and oil. The study aims to analyze the costs of maize production in Egypt during the time period (2000-2012). The ordinary least squares technique is used to estimate the parameters of the regression equation and the Cobb-Douglas production function was employed. During the time period (2000-2012), the labor wages has the highest annual average percentage growth rate which is 11.04%, while the insecticides has the lowest annual average percentage growth rate which is 4.06%. The results indicate that the fertilizers cost is significant at the level of 1%, while the labor wages and machinery cost are significant at the level of 5%. The study recommends that the government should release recommendations to farmers about the fertilizers rates to use based on the scientific research findings; improve the training of labor especially the skills of cultivation and harvesting of product; improve the technology and procedures of work; and the government should implement the land consolidation system, all of this will help to decrease the costs of maize production in Egypt.

REFERENCES

Abu Samah, B. and Suandi, T. (1999). Statistics for Social Research with Computer Application. Putra Malaysia University.

Anupama, J., Singh, R.P., and Kumar, R. (2005). Technical efficiency in maize production in Madhya Pradesh: Estimation and implications. Agricultural Economics Research Review 18: 305-315.

Aye, G.C., and Mungatana, E.D. (2010). Technical efficiency of traditional and hybrid maize farmers in Nigeria: Comparison of alternative approaches. African Journal of Agricultural Research 5 (21): 2909-2917.

FAOSTAT ((2000-2012)). Statistics Division, Food and Agriculture Organization of the United Nations, Rome, Italy.

Hasan, M.F. (2008). Economic efficiency and constraints of maize production in the northern region of Bangladesh. Journal of Innovation & Development Strategy 2 (1): 18-32.

MALR ((2000-2012)). Agricultural Statistics. Economic Affairs Sector, Ministry of Agriculture and Land Reclamation, Egypt.

Mohiuddin, M., Karim, M.R., Rashid, M.H., and Huda, M.S. (2007). Efficiency and sustainability of maize cultivation in an area of Bangladesh. International Journal of Sustainable Crop Production 2 (3): 44-52.

Oyewo, I.O. (2011). Technical efficiency of maize production in Oyo state. Journal of Economics and International Finance 3 (4): 211-216.

Pepinsky, T. and Tobin, J. (2003). Introduction to Regression and Data Analysis. Statlab Workshop.

Solieman, N.Y., Ahmed, M.A., Heggi, M.A.M. (2015). Technological effect on increasing productivity of maize crop in Egypt. Advances in Environmental Biology 9(14): 1-8.

تحليل تكاليف إنتاج الذرة في مصر
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يعتبر الذرة محصولا مهما في مصر نظرا لأهميتها في تغذية الإنسان وتغذية الحيوانات والدواجن، كما تدخل في بعض الصناعات مثل استخراج الجلوكوز والفركتوز والنفط. تهدف الدراسة إلى تحليل تكاليف إنتاج الذرة في مصر خلال الفترة (2000-2012). بلغت أجور العمالة أعلى معدل نمو سنوي متوسط 11.04٪ في الفترة الزمنية (2000-2012)، في حين أن المبيدات الحشرية لها أدنى معدل نمو سنوي متوسط 4.06٪. تشير النتائج إلى أن تكلفة الأسمدة معنوية عند مستوى معنوي 1٪، في حين أن تكلفة أجور العمالة والآلات معنوية عند مستوى معنوي 5٪. توصي الدراسة الحكومة بإصدار توصيات للمزارعين حول معدلات الأسمدة لاستخدامها بناء على نتائج البحث العلمي؛ تحسين تدريب العمالة وخاصة مهارات الزراعة و الحصاد ؛ تحسين التكنولوجيا وإجراءات العمل؛ كما يجب على الحكومة تنفيذ نظام التجميع الحيازي، كل ذلك سيساعد على خفض تكاليف إنتاج الذرة في مصر.