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A Statistical Analysis in Productivity and Profitability Variations for some Vegetable Crops in Middle Egypt Region

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ABSTRACT

Undoubtedly, statistical analysis is very effective method to indicate the most factors were changed in both productivity and profitability,as a result of variations and other indicators related to common vegetable crops are cucumber, eggplant, okra, onion, pepper and tomato grown in middle Egyptgovernorates are Beni Suef, Minia and Assuit respectively.Although the results of models indicate that tomatoes crop may be the most profitable crop in these governorates regardless the productivity variations, it is difficult to extrapolate this result for the larger set of farmers. While these results do not suggest any particular clear course of action for farmers to improve the profitability as direct cause of productivity increase, they do provide some minor evidence that fertilizer and harvest labor inputs may be negatively affecting profitability realized by farmers to an extent. Results showed that there was no statistical evidence that aggregated labor and capital costs had a significant effect on the obtained output revenue. However, there is a significant effect of input cost on the resulting output revenue: a 1% increase in input cost would likely result in 56.67% increase in the output reflection.

INTRODUCTION

This research paper is prepared to determine statistically the impact of variations in both productivity and profitability for farmers grew these scattered vegetable crops in selected middle Egypt governorates, and by the entire region because the profitability of widely grown crops varies by governorate. Therefore, due to this variability, the most cost effectiveinterventions for crop value chains may vary by governorate to provide the solid reasons of productivity and profitability variations.

Data Analysis and Methodology

Considered the high variability of the data and analysis results, regression were conducted to evaluate potential influences of various independent inputs and outputs particularly to show profitable and unprofitable results, a statistical analysis was conducted to identify the possible impacts of variation in both factorsfrom a biased sample of 170 farmers in the selected governorates. Standard deviation is a common method used to measure expected risk1, which quantifies the average amount that an observed return on profitability differs from the return on productivity. Base Cobb-Douglas production function has been used as a preliminaryanalysis2. In additionstandardized return3 were used to measure individual farmer return ($Return_{Farmer}$) results as deviations ($\sigma_{Return_{Upper\ Egypt}}$) from the mean profitability for all farmers in middle Egypt ($\mu Return_{Upper\ Egypt}$). Standard return statistically minimizes the effect of extreme and abnormal values in the data. However, an important assumption of this statistical analysis is that the standard return measures are normally distributed. By making this assumption, a simpleleast squares regression employed to determine the linear effect (β) that exogenous variables could have on a farmer's profit and yield.

$$Standardized\ Return = \frac{Return_{Farmer} - \mu Return_{Upper\ Egypt}}{\sigma_{Return_{Upper\ Egypt}}}$$

RESULTS AND DISCUSSION

Crop production aspects in middle Egyptgovernorates is shown in Table 1, the analysis focuses on famous six vegetable crops that achieved more than 20 observations in order to provide results with sold statistical evidence, as shown in Table 1. These crops include cucumber, eggplant, okra, onion, pepper and tomato. Among these crops, tomato has the highest number of observations with 37 followed by cucumber was 33.

Table 1. The selected vegetable crops in the survey data farmers.

Crop	Assuit	Beni Suef	Minia	Total
Cucumber	8	12	13	33
Eggplant	9	6	8	23
Okra	7	11	6	24
Onion	7	8	10	25
Pepper	9	9	10	28
Tomato	9	12	16	37
Total	49	58	63	170

Source: Study sample surveys.

1- Production prospective for selected vegetable crops inupper Egypt Governorates.

The data is shown in table # 2 clearly provide an explanation evidence of the relationship between productivity and profitability, although Okra crop average productivity was the lowest ranged 3 ton/ Fadden despite realized the highest profit ranged 23,389 LE/Fadden except in Minia . On the other hand pepper crop was high productivity ranked 12 ton/Fadden with very low profit recorded 1057 LE/Fadden. Always tomato crophad reflected productivity increase to its profitability with average 17 ton/Fadden in the middle Egyptgovernorates. Eggplant yield amounted 10 ton/Fadden with low profitability reached 3305 LE/Fadden in Beni Suef governorate.

2-Statistical Analysis ofVariation in Profitability

Given the variation in return among the farmers of the selected governorates, and the existence of farmers with particularly profitable and unprofitable return results, a statistical analysis was conducted to identify the possible impact of variation in return results. In order to make it comparable among farmers[4].

[1] **Ibrahim Soliman, Fabian Capitanio, Luigi Cerciello, Risk Assessment of Major Crops In Egyptian Agriculture, March 2013.**

[2] **Damodar Gujarati, Econometrics by Example,Palgrave Macmillan in the UK is an imprint of Macmillan Publishers Limited,registered in England, company number 785998, of Houndmills, Basingstoke,Hampshire RG21 6XS. ISBN 978-0-230-29039-6, page 56, 2011.**

[3] **Mubarik Ali, Dynamics of vegetable production, distribution and consumption in Asia,Asian Vegetable Research and Development Center. AVRDC publication no. 00-498,470 p. ISBN: 92-9058-116-5 , AVRDC publication no. 00-498,2000.**

[4] **NoranizaYusoff, Analysis on Cost and Profit in Farming Activity in Malaysia, Journal of Modern Accounting and Auditing, April 2016, Vol. 12, No. 4, 183-207.**

Table 2. Total cost, profit andyield for selected crops across middle Egyptgovernorates.

Governorate	Crop	Average Price (LE/Ton)	Revenue (LE/Fadden)	Cost (LE/Fadden)	Profit (LE/Fadden)	Crop Yield (Ton/Fadden)
Beni Suef	Cucumber	2120	22,543	7,747	14,796	10.1
	Eggplant	1500	13,447	10,142	*3,305*	*10.0*
	Okra	7200	43,200	8000	35200	6.0
	Onion	2300	18,400	10000	8400	8.0
	Pepper	1380	9,005	9,019	-14	8.7
	Tomato	1230	15,808	11,526	4,283	12.5
Assuit	Cucumber	1130	12,958	10,568	2,390	10.5
	Eggplant	840	24,800	15,362	*9,438*	*28.2*
	Okra	8000	46,080	7,731	38,350	5.8
	Onion	2000	16,000	11,645	4,355	8.0
	Pepper	1220	20,556	18,801	1,755	16.9
	Tomato	830	17,944	14,396	3,548	22.1
Minia	Cucumber	1070	8,730	7,437	1,294	9.9
	Eggplant	500	15,000	12,396	*2,604*	*30.0*
	Okra	7500	5,441	8,825	-3,384	0.8
	Onion	2700	26,190	11,400	14,790	9.7
	Pepper	1000	11,313	9,883	1,430	11.3
	Tomato	1700	23,869	11,871	11,998	17.2
Total	Cucumber	1440	14744	8584	6160	10
	Eggplant	947	17749	12633	5116	20
	Okra	7567	31574	8185	23,389	3
	Onion	2333	20197	11015	9182	9
	Pepper	1200	13625	12568	1057	12
	Tomato	1253	19207	12598	6610	17

Source: Study samplesurveys.

An initial model was developed to measure the effect that inputs such as irrigation, fertilizer, weedicide, insecticide, disease treatments, and labor had on a farmer's standard return. It is assumed that these inputs are exogenous as they rely on farmer decision making given available economic resources[5]. Additional variables were included to direct for the type of crop (using an indicator variable for cucumber, eggplant, okra, onion, pepper, and tomato) in order to compare the standard return of frequently grown crops to less frequently grown crops. Finally, farmer household composition variables were included number of family members by gender and age (adult males, adult females, male children, and female children) to account for possible effects of economic resources present due to family needs. The initial estimated model is shown below.

Model 1:

$$\begin{aligned} Standard\ Return &= \beta_0 + \beta_1 Cucumber + \beta_2 Eggplant \\ &+ \beta_3 Okra + \beta_4 Onion + \beta_5 Pepper \\ &+ \beta_6 Tomato + \beta_7 Irrigation \\ &+ \beta_8 Fertilizer + \beta_9 Insecticide \\ &+ \beta_{10} Weedicide + \beta_{11} DiseaseT \\ &+ \beta_{12} HarvestL + \beta_{13} AST + \beta_{14} BNS \\ &+ \beta_{15} MIN + \beta_{16} NumMaleH \\ &+ \beta_{17} NumWomH + \beta_{18} NumBoyH \\ &+ \beta_{19} NumGirlH \end{aligned}$$

Table 3. Summary statistics in profitability for Model 1

Predictor	Effect Standard return	Standard Error
Fertilizer (total amount /fed)	-0.0000182	0.0000106
Harvest labor (total amount /fed)	-0.0024801	0.0014203
Irrigation (total amount, cubic meter/fed)	-0.0002713	0.000522
Weedicide (total amount / fed)	-0.0024087	0.0553292
Insecticide (total amount / fed)	0.0019662	0.0076984
Disease treatment (total amount /fed)	-0.0001827	0.0096469
Cucumber	0.0501567	0.2112117
Eggplant	-0.0505343	0.2565498
Okra	0.2939594	0.2533542
Onion	-0.2872098	0.2919071
Pepper	0.4522412	0.2381521
Tomato	*0.5573605**	0.2071447
Assuit(AST)	0.3687871	0.4191097
Bani Suef(BNS)	-0.087402	0.3993902
Minia(MIN)	-0.0006697	0.4023085
Number of adult males at household	0.0542354	0.0393088
Number of adult females at household	-0.0327615	0.0500138
Number of male children at household	0.0395856	0.0494538
Number of female children at household	0.0287469	0.0455496
Model constant	-0.2730847	0.3871909

***indicates statistical significance at the 5% level**

Results showed that there was no statistical evidence to suggest that any of the inputs (irrigation, fertilizer, insecticides, weedicides, disease treatments, and harvest labor) had a significant effect on the farmer's profitability,a slightly positive significant impact at the 5% level. There was no statistical evidence that any governorate had a significant different return when compared to other governorate, nor did household or labor composition have a

[5]**Dr. Rajesh Buch,Global Sustainability Solutions Services, Dr. Richard Rushforth Walton Sustainability Solutions Initiatives, Arizona State University, Initial Cost-Benefit Analysis, November, 2017.**

significant effect on returnrealized by the farmer[6]. Model statistics and diagnostics are shown in Table # 3. Only a statistically significant (at 5% level) was found between tomatoes and the rest of selected crops.

In the absenceof statistical significance evidence, a second model was constructed by focusing on inputs with the highest costs of fertilizerand Harvest labor. Fertilizers and harvesting represents about 60% of the total costs. The second model is shown below.

Model 2:

$$\boldsymbol{Standard\ Return} = \boldsymbol{\beta_0 + \beta_1 Cucumber + \beta_2 Eggplant + \beta_3 Okra + \beta_4 Onion + \beta_5 Pepper + \beta_6 Tomato + \beta_7 Fertilizer + \beta_8 HarvestL + \beta_9 AST + \beta_{10} BNS + \beta_{11} MIN + \beta_{12} NumMaleH + \beta_{13} NumWomH + \beta_{14} NumBoyH + \beta_{15} NumGirlH}$$

It was found that taken into regard together, there was no statistical evidence to suggest a significant impact of these inputs on the profitability, nor any effect of the additional variables used to compute for other effects on productivity. Only a statistically significant (at 5% level) was found between tomatoes and the rest of the selected crops with regards to the mean profitability. Results are shown in Table #4as follow.

Table 4. Summary statistics in profitability for Model 2

Predictor	Effect Standard return	Standard Error
Fertilizer (total amount /fed)	-0.0000178	0.0000103
Harvest labor (total amount /fed)	-0.0023722	0.0013605
Cucumber	0.0505272	0.2088438
Eggplant	-0.0493806	0.2534872
Okra	0.286702	0.2481882
Onion	-0.2892095	0.2896388
Pepper	0.4515235	0.2348809
Tomato	0.5484311*	0.2027162
Assuit(AST)	-0.0895817	0.3855633
Bani Suef(BNS)	0.3354295	0.3918378
Minia(MIN)	0.5511688	0.4003835
Number of adult females at household	-0.031623	0.049462
Number of male children at household	0.0416826	0.0488521
Number of female children at household	0.0265207	0.0450411
Model constant	-0.2666322	0.3742415

***indicates statistical significance at the 5% level**

If only one input was analyzed at the time, either including the fertilizer or the harvest labor amount, along with the other crop, governorate, and home composition variables, the models are shown as follow.

Model 3:

$$\boldsymbol{Standard\ Return} = \boldsymbol{\beta_0 + \beta_1 Cucumber + \beta_2 Eggplant + \beta_3 Okra + \beta_4 Onion + \beta_5 Pepper + \beta_6 Tomato + \beta_7 Fertilizer + \beta_8 AST + \beta_9 BNS + \beta_{10} MIN + \beta_{11} NumMaleH + \beta_{12} NumWomH + \beta_{13} NumBoyH + \beta_{14} NumGirlH}$$

Model 4:

$$\boldsymbol{Standard\ Return} = \boldsymbol{\beta_0 + \beta_1 Cucumber + \beta_2 Eggplant + \beta_3 Okra + \beta_4 Onion + \beta_5 Pepper + \beta_6 Tomato + \beta_7 HarvestL + \beta_8 AST + \beta_9 BNS + \beta_{10} MIN + \beta_{11} NumMaleH + \beta_{12} NumWomH + \beta_{13} NumBoyH + \beta_{14} NumGirlH}$$

Both inputs have a small, yet statistically significant at the 5% level, and negative effect on the standard return, in addition to the significantly larger 0.53 and 0.51 respectively for models 3 and 4, and the deviation was higher than average return for tomatoes. Table# 5 shown the resulting effect magnitude and standard error for each input in models 3 and 4.

Table 5. Summary statistics in profitability for Model 3 and Model 4

Model	Predictor	Effect Standard return	Standard Error
3	Fertilizer (total amount /fed)	-0.00002*	0.001131
4	Harvest labor (total amount /fed)	-0.00299*	0.000006
3	Tomato	0.5250338*	0.2046054
4	Tomato	0.5143531*	0.2025111

***indicates statistical significance at the 5% level**

The increasing in crop inputs may have a negative effect on standard return, when disaggregated individually. However, given that the effects of the other non-input variables (with the exception of the indicator for tomatoes) were not statistically significant, a simple model of only looking at the effects of the inputs by themselves was established.

Model 5:

$$\boldsymbol{Standard\ Return} = \boldsymbol{\beta_0 + \beta_1 Irrigation + \beta_2 Fertilizer + \beta_3 Insecticide + \beta_4 Weedicide + \beta_5 DieaseT + \beta_6 HarvestL}$$

The results for this model did not provide any statistical evidence for an effect of any of the inputs on the standard return of farmers, as shown in Table #6.

Table 6. Summary statistics in profitability for Model 5

Predictor	Effect Standard return	Standard Error
Fertilizer (total amount /fed)	-0.000003	0.000009
Harvest labor (total amount /fed)	-0.0011435	0.0011997
Irrigation (total amount, cubic meter/fed)	-0.0001737	0.0005047
Weedicide (total amount / fed)	0.0112277	0.0525429
Insecticide (total amount / fed)	-0.0016323	0.0066829
Disease treatment (total amount /fed)	-0.0001071	0.0056285
Model constant	0.0897714	0.093053

***indicates statistical significance at the 5% level**

3-Statistical Analysis of Variation in Crop productivity

Another perspective for the analysisto analyze the determinants of crop productivity by comparing yields among the most selected or popular crops and to compare crop yields among the governorates of middle Egypt region. Analyzing the yields provide an indication of the effectiveness of input usage in the proportion of crops grown by farmers. Coming a similar calculation like standard return models, it is possible to write a simple least squares model for crop yield by Fadden.

[6] **Dr. Diab; Magdi and Hassan S. Abbas, Greenhouse- grown Cucumber as an Alternative to Field Productionand its Economic Feasibility in Aswan Governorate, Egypt, April, 2016.**

Model 6:

$$Yield = \beta_0 + \beta_1 Cucumber + \beta_2 Eggplant + \beta_3 Okra + \beta_4 Onion + \beta_5 Pepper + \beta_6 Tomato + \beta_7 Irrigation + \beta_8 Fertilizer + \beta_9 Insecticide + \beta_{10} Weedicide + \beta_{11} DiseaseT + \beta_{12} HarvestL + \beta_{13} AST + \beta_{14} BNS + \beta_{15} MIN + \beta_{17} NumMaleH + \beta_{18} NumWomH + \beta_{19} NumBoyH + \beta_{20} NumGirlH$$

The calculation for this model did not confirm any statistical evidence that the amounts of any inputs had a significant effect on crop yields. However, it was found that tomatoes had a significant higher yield (14.9 tons per Fadden at the 5% level). Eggplants had a significant higher yield (11.9 tons per Fadden at the 5% level). The results of Model 6 also showed that household'snumber of female children had a 1.52 ton increase in crop yields. It's obvious from table #7 below estimates the parameter that both tomato and eggplant present the best prospects of productivity.

Table 7. Summary statistics in productivityfor Model 6

Predictor	Effect (Tons Yield Per Fadden)	Standard Error
Fertilizer (total amount /fed)	-0.00002	0.0001597
Harvest labor (total amount /fed)	-0.0036965	0.0213284
Irrigation (total amount, cubic meter/fed)	-0.0077807	0.0078385
Weedicide (total amount / fed)	-0.1063164	0.8308792
Insecticide (total amount / fed)	-0.0525075	0.1156066
Disease treatment (total amount /fed)	0.1324449	0.1448673
Cucumber	1.993148	3.17177
Eggplant	11.96531*	3.852612
Okra	-2.051863	3.804624
Onion	2.794998	4.383573
Pepper	6.214106	3.576334
Tomato	14.92898*	3.110695
Assuit(AST)	2.382084	5.99765
Bani Suef(BNS)	5.038083	6.054014
Minia(MIN)	11.20838	6.182448
Number of adult females at household	-0.86533	0.7510587
Number of male children at household	0.6502186	0.7426478
Number of female children at household	1.528748*	0.6840194
Model constant	-3.928176	5.814453

***indicates statistical significance at the 5% level**

To improve the productivity and profitability of farming operations, the number of farmers will need to be increased to prove the findings of possible effect of inputs, and identification of more productive crops.

4- Developing a famous Production Function from selectedsample.

Celebrated Cobb–Douglas production function were considered to develop a proper production model for the selected middle Egypt governorates included in this researchpaper, which may be expressed as:

$$Y = AL^{\beta_L} K^{\beta_K}$$

Where Y is the output in revenue; L is the labor cost; K is the capital cost; A is a constant, which corresponds to basis level of production in the absence of jugglery of labor and capital.

β_L, andβ_K represent the parameters controlling the marginal effect of labor and capital, respectively. It is possible to estimate thisfunction by the use of simple least squares regression by taking the natural logarithm of both sides7. The resulting calculation form for the equation is shown below.

$$\ln(Y) = A + \beta_L \ln(L) + \beta_K \ln(K)$$

The resulting form of the function allows for the interpretation of β_L and β_K is made in the terms of elasticities, a percent increase in labor or capital will result in a $\beta_L$orβ_K increase in the quantity of output revenue obtained. Ln(Y) represent the revenue of the output.

The choice of this particular production function was made to account for the rather nature of the production ofthe selected vegetable crops in middle Egypt region[8]. Labor costs included, in this case, the total cost made for male, female and children labor conducted in every activity related to the production, while capital costs included the expenses related to equipment presented in the production activities. One addition made for this preparatory analysis was the addition of chemical input costs into the production function to account for the importance of the usage of inputs such as; fertilizers and other chemical products required in different activities related to crop production.

$$\ln(Y) = A + \beta_L \ln(L) + \beta_K \ln(K) + \beta_I \ln(I)$$

Where I represents the input expenditures at the farm, and β_I representing the elasticity of output with respect to input expenditures. Table 8 below show the results for the production function estimated through ordinary least squares:

Table 8. Summary statistics on the estimated production function

Predictor	Effect (%ΔRevenue/1%↑Factor)	Standard Error
Ln(Labor)	0.1883413	0.1727271
Ln(Capital)	0.1363918	0.1060288
Ln(Inputs)	*0.5667708**	0.1071602
Model constant	2.051411	1.475182

***indicates statistical significance at the 5% level**

This result in the above table 8 showed there is a significant effect of input cost on the resulting output revenue: a 1% increase in input cost would likely result in 56.67% increase in the output. It likelyreflect the idea for some inputs may be of significant importance to production, such as fertilizers. However, it was very difficult to determine a particularly significant input's impact on revenue rather than productivity to validate the production function.

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تحليل إحصائي لأثر اختلافات الانتاجية والربحية لبعض محاصيل الخضر في منطقة مصر الوسطي

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من الناحية الاقتصادية تعتبر الطريقة الاحصائية لقياس وتحليل أثر الاختلاف في كل من الانتاجية والربحية لبعض محاصيل الخضر من الطرق الهامة التي تعكس بصورة مباشرة قيمة العائد الناتج من زيادة متوسط الانتاجية من جانب ،و من جانب آخر يتناول تحليل محددات تلك الانتاجية نفسها بالمقارنة بمعدلات الانتاجية بين المحاصيل الأكثر انتشارا وزراعة بين جميع المحاصيل الأخرى، وكذلك مقارنة انتاجية هذه المحاصيل بين محافظات منطقةمصر الوسطي. ومن مميزات هذا التحليل لاختلافات الانتاجية والعائد انه يعطي مؤشرا أولي لفعالية استخدام مقادير المدخلات الانتاجية التي تحتاجها المحاصيل والتي يستخدمها المزارعيين بكميات مثلي كانعكاس طبيعي لزيادة معدل الانتاجية. وبالنظر الي التباين في العائد والانتاجية للمحاصيل المختارة من العينة بين مزارعي محافظات مصر الوسطي نجد انها تتفق بشكل خاص مع نتائج العائد المربح والغير مربح ، وباجراء التحليل الإحصائي لتحديد الأسباب المحتملة للتغير في نتائج العائد وفقا لتغير الانتاجية وجعلها قابلة للمقارنة بين المحاصيل المختارة تبين ان معظم هذه المحاصيل لم تعكس بالدرجة الكافية معدل زيادة الانتاجية مقارنة بالعائد المنشود اذ اتضح انها تتغير وفقا لعوامل اخري في كل محافظة وكان من اهم هذه العوامل كل من السعر والجودة ،ولذلك تم توحيد معايير العائد علي الانتاجية لقياسه بصفة فردية تبعا لكل محصول. ومن نتائج استخدام العائد القياسي في التحليل تقليل تأثير كل من القيم الشاذة والمتطرفة في البيانات للوصول الي نتائج واقعية تتفق مع المنطق الاحصائي وتعبرعن طبيعة العلاقة الموجودة بين معدل الانتاجية والربحية لمجموعة محاصيل الخضر المختارة ،وعلي التوالي بين المحافظات الثلاثة المختارة وهي محافظة أسيوطو بني سويف ثم المنيا . ومما لاشك فيه ان وجود احد الافتراضات الهامة التي بني عليه التحليل الإحصائي للاختلافات بين الانتاجية والربحية هي أن العائدالقياسي يتم حساب توزيعه طبيعيا من خلال حساب الانحدار البسيط باستخدام طريقة المربعات الصغرى لتحديد التأثير الخطي (β) والذي يمكن أن تحدثه المتغيرات الخارجية المتنبأ بها على العائد القياسي. وبناءا عليه تم افتراض نموذج مبدئي لقياس تأثير بعض المدخلات مثل الري والأسمدة والمبيدات الحشرية ومبيدات الحشائش ومقاومة الامراض والعمالة لقياس عائدهاالقياسي ،والتي من المفترض انها مدخلات خارجية تعتمد على قرار المزارع ومدي توفير الموارد الاقتصادية المتاحة لديه الا ان محصول البامية كان ذلك بمثابة مدلول جيد علي أن معدل الانتاجية لا يؤخذ في الاعتبار بالدرجة الاولي بالمقارنة بمعدل الربحية . ومن الجدير بالذكر انه تم اشتمال متغيرات اخري إضافية للتحكم في نوع المحصول (باستخدام مؤشر متغير لمحصول الخيار ، والباذنجان ، والبامية ، والبصل ، والفلفل ، والطماطم) لمقارنة العائد القياسي منها والتي تزرع في كثير من الأحيان أكثر من غيرها نظرا للطلب المتزايد عليها ،وللعمل علي تحسين معدل الربحية والعائد بهما اعتمادا علي مؤشرات زيادة الانتاجية فان يتطلب الأمر دراسة عدد كبير من المزارعين لإثبات نتائج التأثير المتوقع للمدخلات ، وتحديد المزيد من المحاصيل ذات الإنتاجية المرتفعة ووالمحققة ربحية عالية. واتضح جليا من النتائج أنه لا يوجد دليل إحصائي على أن إجمالي التكاليف للعمالة ،وكذلك التكاليف الرأسمالية كان له تأثير كبير على عائدات الإنتاج التي تم الحصول عليها. كما اتضح ايضا ان هناك تأثير كبير عند مستوى معنوية 1٪ من تكاليف المدخلات بالنسبة لإيرادات الانتاج : حيث من المرجح أن تؤدي الزيادة في تكاليف هذه المدخلات بنسبة معنوية 1٪ إلى زيادة كبيرة تصل الي 56.67٪ في الانتاج.وخلاصة القول ان معدل زيادة الانتاجية لم ينعكس بشكل واضح من الناحية الاحصائية علي زيادة معدل الربحية بل ان أثر الاختلافات بين كل من معدل الانتاجية والربحية كانت في معظم الاحيان انعكاس لمتوسط السعر للمحصول أو عوامل أخري لم يتناولها البحث.