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Estimation of the loss of taro yield during marketing stage and its effect on the price of the Producer

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Abstract: Taro is one of the most important crops economically, The research problem is the lack of sufficient studies to determine the extent of losses in the post-harvest period, the absence of accurate data on the economics of production, and the scarcity of scientific research on this crop. The objective of the research was to estimate the percentage of taro in the post-harvest level at the farm, On the economics of taro production and access to economic derivatives of the production functions and costs of the research sample and productivity estimated about the volume of production which reduces costs. The average cultivated area of taro in Egypt during the period (2000-2016) was 7.9 thousand feddan, with 13.72 tons/feddan and a total production of 108.7 thousand tons. The average area cultivated in Menoufia during the same period was 2.15 thousand feddan with a production capacity of 13.82 tons/Feddan with an average production of 31.22 thousand tons, and the average percentage of the production of Menoufia governorate for the total production in Egypt during the same period 28.09%. The time trend for the development of taro area in Menoufia Governorate during the same period showed that it has taken an increasing general trend of 5 feddan per year, as well as the trend of taro production in the governorate of Menoufia during the same period showed that it has taken an increasing trend of 3 tons annually. By accumulating 10 tubers, their weights were calculated daily for one month at room temperature during December 2017. It was found that the percentage of losses in the weights of the tubers was about 15.9% with a minimum of 11.4% and a maximum of 19.6%. The total area cultivated with taro in the sample used in the research was about 32 feddan with an average total cost per feddan of 23.62 thousand pounds and the average production of taro 10.92 tons per feddan. The average price of taro tar was about LE 3648 and the average yield of taro was 39.75 thousand pounds The yield per feddan of taro was about 16 thousand pounds, one in addition to the average yield of the loaded crop, which turned out to be the highest net yield of the crop was the yield of zucchini, where the average net yield of zucchini 8034 pounds/feddan and Malukhia 6548 pounds / fed and finally corn 3059 pounds/feddan. Using the logarithmic form, it was possible to obtain the elasticity of the independent production elements of the taro yield in the research sample. The equation indicated that the increase in the use of the elements (labor, fertilizer, super phosphate and potassium sulphate fertilizer by 10% increased production by 5.7% 9%. The same equation indicates that there is excessive use of seeds as well as municipal fertilizers and that their rates have not been substantiated. For the cost function, the research showed that the civilian size of the costs is 14.8 tons.

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Introduction:

One of the most important objectives of the Egyptian agricultural policy is to achieve maximum self-sufficiency of food commodities by maximizing production in order to meet the increasing food consumption needs of the growing population. This is based on three main axes: horizontal expansion, vertical expansion, Reduce agricultural losses, which is cultivated for its always-under-ground tubers, a vegetable rich in carbohydrates and protein, which like potatoes in nutritional value, It is a summer crop that does not tolerate frost. It needs a long warm growth season and high temperature. It is preferred to grow it in yellow soil, light or heavy, fertile and good drainage, and when cultivating it, consider the following:

1- Reproduces with small whole tubers.

2- Planted from mid-February till late April. March is considered the most suitable planting time, but it is considered a stressful crop of soil. It is preferred to be followed by cultivation of a non-stressed crop such as legumes or semi-strainers.

3- It is recommended to follow the cycle of agriculture three or five, and usually resort to farmers to cultivate clover crop before taro cultivation because of the impact on the increase of soil fertility and advises the early processing of the soil to accelerate

the decomposition of the organic material on which taro will depend on nutrition in its initial growth.

4- Taro crop occupies the land from 7-9 months, some farmers resort to the exploitation of land in its first growth periods with short-lived crops such as beans - cucumber - Courgettes or corn.

Problem of the research:

Although the economic and nutritional importance of taro crop there are no accurate studies to determine the percentage of losses in the post-harvest period due to the lack of accurate data indicating the percentage of losses to determine the factors affecting, especially in the post-harvest period at the product level, The existence of accurate data on the economics of production, and the scarcity of scientific research on this crop as well as the lack of data about the cost of production and items and profit and net return of production.

Objective of the research:

1- Estimating the loss ratio of taro loss in the post-harvest phase at the farm level.

2- Identify the economics of taro production (production function and cost function) by using the sampling technique (questionnaire)

3- Obtain the economic derivatives of the production functions and costs of the research sample and estimate the volume of production that reduces costs and the volume of production that maximize profit.

Data sources and the Methodology:

The research was based on both descriptive and quantitative analysis of the data. It was also based on some statistical measures such as estimation of production functions and costs, as well as the use of statistical sampling method in the selection of the research sample. The governorates in which taro cultivation was selected were the largest governorate in terms of area and production, Menoufia was divided into districts. Random number tables were used to select two data collection centers where each farmer is the selection unit. The sample is as follows in Table (1).

Table (1) The relative importance of the number of farmers and the area planted with taro in the research sample

Source: Sample data

The sample was selected by using the random number table, two villages were selected from the Shebin El Koum Center, Dalaton, Shwanan, and two villages from Al-Bagour Center, Kafr Manawahla and Kom Al-Dabaa. The data were collected by a questionnaire for the harvest collected in 2017. The sample description As follows:

The data were collected from 64 farms from these areas. 17 farmers from Kfar Manawahla village, 15 from the village of Koum al-Dabaa 19 from Shwanan village and 13 from the village of Dalaton, (the total number of Bajour 32 farmers, Shebin El Koum 32 farmers).

3. Results and Discussion:

The economic importance of taro:

Table (2) shows the area, production and productivity of taro in Egypt during the period (2000-2016). The average cultivated area in Egypt during that period reached 7.9 thousand feddan with a productivity 13.72 tons / fed. total production 108.7 thousand ton, between a minimum area of 5.7 thousand feddans in 2016 and a maximum of 10.6 thousand feddans in 2008, while the productivity ranged between a minimum of 9.3 tons / feddan in 2002 and a maximum of 15.7 tons / feddan in 2015, while the production ranged between a minimum of 66.3 thousand tons in 2002 and a maximum of 151.97 thousand tons in 2008.

While the average cultivated area in the governorate of Menoufia during the same period was 2.15 thousand feddan with a productivity of 13.82 tons/fed with an average production of 31.22 thousand tons. The area ranged between a minimum of 0.55 thousand feddan in 2000 and a maximum of 3.47 thousand feddans in 2014, Ton/fed in 2001 and a maximum of 18.1 tons/feddan in 2007 as well as production ranged between a minimum of 4.78 thousand tons in 2000 and a maximum of 50.92 thousand tons in 2014.

As for the average of Menoufia governorate in Egypt, the average percentage of the production of Menoufia Governorate in Egypt was 28.1%, ranging between a minimum of 6.2% in 2000 and a maximum of 54.12% in 2016.

Evolution of the area and production of taro crop in Egypt and the governorate of Menoufia:

The analysis of the general trend of taro area in Egypt and Menoufia governorate as well as production and productivity was as follows:

Table (2) area, production and productivity of taro in Egypt and Menoufia governorate during the period (2000-2016)

Source: Ministry of Agriculture and land Reclamation, Central Administration for Agric. Economic, different volumes Agric. Economics bulletin.

Table (3) Results of analysis of the development of taro production, area and productivity in Egypt and Menoufia governorate during the period (2000-2016)

Variable	The general time trend equation	R^2	F
Ya Taro area in Egypt	$Y_a = 2008.3 - 3.96\ X_i$ (0.41-)	0.02	0.2
Yb Taro area in Menofia	$Y_b = -6072.7 + 0.005\ X_i$ (4.9)	0.62	*24.1
Yc Taro production in Egypt	$Y_c = 2001.7 + 5.75\ X_i$ (1.1)	0.07	1.14
Yd Taro production in Menofia	$Y_d = 1999.7 + 0.003\ X_i$ (5.1)	0.63	*25.81
Ye Taro Productivity in Egypt	$Y_e = 1982.3 + 1.87\ X_i$ (2.82)	0.35	*7.95
Yt Taro Productivity in Menofia	$Y_f = 1991.4 + 1.19\ X_i$ (3.35)	0.43	*11.21

* at a significant level of 1%

Source: Table No (2).

Where: Y_a: represents taro area in Egypt during the period (2000-2016).

Y_b: The area of taro in the governorate of Menoufia during (2000-2016).

Y_c: represents the production of taro in Egypt during the period (2000-2016).

Y_d: represents the production of Taro in the governorate of Menoufia (2000-2016).

Y_e: represents the productivity of Taro in Egypt during the period (2000-2016).

Y_f: Taro productivity in the province during the period (2000-2016).

Xi: represents time, where i (1.2,3,……..17).

Estimated general time trend for the development of taro area in Egypt during (2000-2016) showed that it took a decreasing general trend but which is not statistically significant, indicating its stability around the mean, equation (1), while estimated general time trend for the development of taro area in Menoufia Governorate during the same period showed that it took an increasing trend of 5 feddans per year, while the value of (F) was 24.1 while the coefficient of determination of 0.62 indicates that 62% of the changes in the area of taro Menoufia is due to the factors that explain the effect of the time element equation (2)

Also estimated general time trend for the development of taro production in Egypt during the study period showed that it took an increasing general trend, which is not statistically significant, indicating its stability around the mean, equation (3), while the estimated general time trend for the development of taro production in Menoufia governorate during the same period showed that it took an increasing trend of 3 tons per year was recorded. The value of F was 25.81, The coefficient of determination was 0.63, indicating that 63% of the changes in taro production in Menoufia governorate are due to the factors that explain the time component of equation (4).

The overall estimated general time trend for the development of taro productivity in Egypt during the study period showed that it took an increasing general trend estimated at 1.87 tons / feddans annually, with a value of (F) 7.95 while the coefficient of determination was about 0.35 equation (5), While general time for the development of taro productivity in the governorate of Menoufia during the same period showed that it took an increasing general trend of 1.19 tons / feddans per year and the value of (F) 11.21 while the value of the coefficient of determination 0.43 equation number (6).

Specifications of taro cultivated in Egypt

Categories [(1)]

1-Egyptian brand: characterized by the production of one large tuber and the size of the large paper and contain a large mucus and subcutaneous color purple and mature after 9 months.

2- American variety: It is characterized by the production of several small tubers and leaves small and small blade and the area of contact with the blade red or crimson and subcutaneous color of white and low mucus and mucus mature after 7 months of cultivation.

Harvest [(2)]

Taro is Maturity after 7-9 months of cultivation depending on the species, where the tubers are harvested from October, November and December. Sometimes farmers resort to cutting the tubers before they mature to benefit from the high prices. This is at the expense of the quantity of the crop.

Storage [(3)]

Taro is characterized by a long dormancy that is easy to store for a long time and there are several ways to store it:

1 -Storage in the soil: leaves the crop in the ground for a period of 2-3 months without harm provided that the plants do not irrigate but may be damaged some of the tubers as a result of injury to the excavator.

2- Storage in Warehouses are well ventilated: After cleaning and ventilation of taro tubers for 3 days in the field or under umbrellas and then stored in stores Warehouses are well ventilated for a period of 2-3 months.

3- Storage in refrigerators: Taro can be stored in refrigerators at a temperature of 10-12 ° C and humidity 85-95% for up to 6 months.

4- Storage in trenches or holes: digging or trenches in a far place from the level of ground water and burrowing with hay and then put the tubers to be stored and then covered with hay and soil, this is an easy way, but it is difficult to control the temperature and humidity suitable for storage of tubers due to exposure to insects and rodents.

Possibilities of loss after harvest [(4)]

1-Mechanical damage: causes natural damage quickly because scratches and wounds cause exposure to microbial infection so transport must be very careful during the harvest and trading processes such as staging, packaging and transport.

2- Low heat: Storage at a temperature below9 ° C causes damage to the internal tissue breakdown and bondage and increase the rate of water loss and increase fungal decay.

3- Pathological damage: The infection of microorganisms is the main cause of infection after the harvest and most of the soil fungus is causing the damage that appear on the surface of the tubers.

When storing the crop, consider the following:

Harvesting should be done in the appropriate maturation stage to prevent deterioration and mold diseases during storage. Tubers should be free of diseases. No injuries or scratches should be caused during collection, so as not to increase the risk of diseases and rapid increase in breathing. It is not recommended to wash the tubers, because the mechanical damage of the tubers increases the rate of rot and the amount of water lost.

Calculation of taro loss in post-harvest using the sample:

10 tubers were brought and their weights were calculated on a daily basis for one month at room temperature during December 2017. The results were as follows:

Table (4) the percentage of losses of cormorants during the storage phase

Source: Sample data

It is clear from the previous table that there is a percentage of losses in the weights of the tubers, which averaged about 15.9 % with a minimum of 11.4% and a maximum of 19.6 %.

Economics of Taro Production

Using the statistical data obtained from the questionnaire, which were discharged according to the nature of the economic analysis and categorized according to the descriptive and quantitative analysis method to reach the results that fit the purpose of the research. This is illustrated by the following results:

First: The cost structure of the taro crop in the research sample:

The descriptive analysis of the production costs of taro in the sample of research in Monofia Governorate is shown in Table 5, which shows the cost elements of the sample of the research in the villages of Kafr Manawlah, which was the average fixed cost 6269.2 pounds/fed while the variable cost was 43359.3 pounds/fed and the average total costs 49628.4 pounds/fed, Also In the village of Kom Dabaa average fixed costs 6675.7 pounds/fed while variable cost42938.1 pounds/fed and the average total costs 49613.8 pounds/fed in the center of the pagor, while in the center of Shebin El Kom in the village of Kom Dabaa average fixed costs 5828.6 pounds/fed while variable cost 43449.8 pounds/fed, a verage total costs49278.4 pounds/fed, Finally the village of Shanwan average fixed costs 6898.6 pounds/fed while the variable cost of 45239.7 pounds/fed and the average total costs 52138.4 pounds/fed.

Table (5) The relative importance of fixed and variable costs of the total cost of tar in the research sample

Source: Sample data

It is clear from Table (6) The total area cultivated with taro in the sample used in the research was about 32 feddan with an average total cost per feddan of 23.62 thousand pounds, and an average production is 10.92 tons per feddan, and the average yield of the loaded crop. The average price per ton of taro was about LE 3648 and the average yield of taro was 39.75 thousand pounds while the net yield of taro was about 16 thousand pounds. The highest net return per feddan was in the village of Shanwan where the net yield of taro was about 23.7 thousand pounds, And the lowest one in the village of Kom Dabaa where it reached 11.56 thousand pounds.

Table (6) The economic yield of taro using the sample method

Source: Sample data

Table (7) shows that the highest net yield for the loaded crop was the zucchini, where the average net yield of zucchini was 8034 pounds/feddan and the melukhiya was 6548 pounds/fed and finally the corn was 3059 pounds / feddan.

Table (7) The economic yield of crops loaded with taro using the sample method

Source: Sample data

But the average yield of the taro was calculated with the net yield of the loaded crop, The highest net yield of the two crops was the melukhiya loaded with taro, the average net yield per feddan was about 25.3 thousand pounds, followed by the taro with corn was 20.4 thousand pounds per feddan. In the end, the zucchini loaded with taro and net yield of about 19.7 thousand pounds per feddan.

Calculation of the production function of the taro crop:

The knowledge of the productive functions of agricultural activities is one of the most important means to assist in the selection of productive inputs, and knowledge of the highest productivity and the extent of integration between these inputs, which leads to the development of methods that are the highest methods of merit, where the production function was estimated, which represents the relationship between the productivity of feddan of taro and The various factors that are supposed to affect this productivity, where the data collected using the questionnaire were used. The linear regression model was formulated in the following mathematical form:

$Y_t = fcx_1, fcx_2, fcx_3, \ldots\ldots\ldots\ldots\ldots fcx_7.$

Where:

$Y_t = f(x_1, x_2, x_3 \ldots\ldots\ldots\ldots\ldots, x_6)$

Y_t represents the yield of taro / year.

X_1 represents the average amount of seed per kilogram / fed.

X_2 represents man/fed employment.

X_3 represents the amount of municipal fertilizer used m^3 / fed.

X_4 represents the amount of super calcium phosphate fertilizer kg / feddan.

X_5 The amount of fertilizer ammonium sulphate kg / feddan.

X_6 The amount of potassium sulphate fertilizer is kg / fed.

The equation representing the taro production function in the linear form was as follows:

$Y_a = 3.53 + 0.01X_1 + 0.31X_2 + 0.12X_3 + 0.03X_4 - 0.14X_5 + 0.9X_6$

(0.52) (5.3) (1.9) (2.1) (-1.7) (5.53)

$R^2 = 0.97$ F= 425

The previous equation indicated that the coefficient of determination was 0.97, which means that the independent factors included in the equation explain about 97% of the changes in the productivity

of the taro crop. The regression equation for each employment has been significant man/fed, the quantity of the used municipal fertilizer m^3/ fed, Calcium phosphate kg/fed, the amount of fertilizer potassium sulfate kg/fed, which is statistically significant at the level of 1%, and the F test was significant at the level of 1%, while the significance of the variable did not prove the amount of ammonia sulfate kg/fed.

The equation representing the taro production function in the logarithmic form was as follows:

$$\log Y_a = -0.61 - 0.05\log X_1 + 0.57\log X_2 - 0.002\log X_3 + 0.48\log X_4 + 0.01\log X_5 + 0.9\log X_6$$
(-0.33) (4.3) (-0.01) (2.8) (0.15) (3.8)
R^2=0.98 F= 1931

From the previous equation, it was possible to obtain the elasticity of the independent production elements from the productive function of the taro yield in the research sample. The equation indicated that the increase of the uses from the elements (labor, super phosphate and potassium sulphate fertilizer by 10% increased production by 5.7%, 4.8%, 9%, as indicated by the same equation to the presence of excessive in the use of seeds as well as municipal fertilizer and if not proved significant rates.

Calculation of the cost function of the taro crop:

The cost function of the taro crop was estimated in the research sample for the agricultural season 2016/2017 in the linear, quadratic and cubic form, where the costs of Y are the dependent factor, X_1 is the yield productivity in the linear form, X_2 is the yield productivity in the squared form, X_3 is the yield productivity in the cubic form, The results of the estimation of these functions are presented below:

(1) Y_a= -531.3 +2341.2 X_1 (55.1)
R^2=0.99 F= 3034
(2) Y_a= -1242 +2491.2 X_1 - 5.67 X_2
(11.6) (-0.65)
R^2=0.99 F= 1505
(3) Y_a= 4993 +272.1 X_1 - 204.2 X_2 + 5.53 X_3
(0.4) (-2.33) (3.45)
R^2=0.99 F= 1182

The quadratic function in equation (2) has been used to estimate the size of the result obtained in the research sample for the taro crop from the research districts as follows:

$$q = \sqrt{\frac{\sigma}{-\beta\ 2}}$$

Where:
q: the reduced cost production.
σ: intercept.
β: Slope.
$= \frac{-124\ 2}{-5.67} = 219.05$
$\sqrt{219.05} = 14.8$

From the above it is clear that the reduced cost production is 14.8 tons/fed and all sample farmers have exceeded this volume of production.

Recommendations:

From the research results there are several recommendations:

1- Taking into account the amount of loss ratio that occurs for the harvest during the post-harvest, which amounted to 15.9% of the tubers weights of the research sample.

2- Loaded Almlokhia with the taro crop during the period of its first growth.

3- Taking into account not to overuse the use of increasing quantities of seeds and municipal fertilizer.

4- The reduced cost production through the sample was 14.8 tons/fed.

5- Increasing the use of the elements (labour, fertilizer, super phosphate and potassium sulphate fertilizer) by 10% increase the production of taro crop by about by 5.7%, 4.8%, 9%.

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