



# EFFECT OF PLOWING DEPTH ON YIELD, A COMPARATIVE STUDY OF WHEAT FARMS IN DIYALA GOVERNORATE, IRAQ IN 2019 SEASON

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## Abstract

In this study, the production function of the wheat farms in Diyala Governorate, Iraq for the season 2019 are investigated. The questionnaire was conducted for a random sample of wheat farmers in Diyala governorate (82 farmers out of 110000 total farmers) was conducted in two groups. The first group consisted of 41 farmers (15-20 cm) who conducted surface tillage and the second group (41 farmers) who conducted deep tillage (20-30 cm), the production function of the two groups was used in the form of a Cup-Douglas after taking the natural logarithm of both the labor resource and the capital resource as independent factors and the natural logarithm of production as a dependent factor. The statistical analysis showed through the production function of the surface tillage farms showed that the elasticity of the production inputs was positive, Optimization of productive resources and thus is considered an best of the production function of deep tillage farms, where the statistical analysis showed that the elasticity of production of the capital resource is negative, indicating that the optimization of the agricultural production process of the deep tillage system is not achieved, it was recommended to apply the system of surface tillage, especially in mud lands (15-20 cm) using the plow disc, as well as the use of improved seed varieties and good production and disease resistance and soil salinity.

**Key words:** tillage depth, Comparative study, Yield, Wheat Farms.

## Introduction

Wheat belongs to the Poaceae (Gramineae) family and is self-pollinating. Wheat can be grown after harvesting various agricultural crops. Success depends on climate, soil and agricultural systems that are associated with economic, technical and social progress. Planted in high humidity areas and followed by a good tillage system and use of manure and chemical fertilizer after removal of the previous crop gives good production comparable to its production in the dry lands in the dry areas. Wheat is one of the most important grain crops in the world. Bread made from (12 - 17%) contains proteins, and their production wastes, such as bran and hay, are used as feed for livestock. Iraqi wheat can be considered good quality for its high protein content. (14-20%) at the top, while in the grain of Canadian wheat and the United States the proportion of protein (16-17%). Wheat is cultivated in large areas in Iraq, especially in the northern regions, but the continuation of the agricultural product in

the use of low-quality items and low production and not to take the categories recommended by scientific circles and neglect the use of modern agricultural methods led to the failure of the productivity of the hectare to reach the global production. As for the majority of the Iraqi soil, the land is plowed once with a typical depth ranging from (10-20cm), depending on the nature of the soil and the degree of hardness, where the light soils grow at a depth of (20cm) and medium (15cm) and heavy soils (10cm) to reduce the formation of blocks in heavy land during plowing (General Authority for Guidance and Agricultural Cooperation, 2011). The agricultural product lacks awareness about the optimal use of technology in agricultural operations, so it uses modern farm equipment without the knowledge and experience of how to increase yields and low costs. The study aims at studying the deep-tilled wheat farms and comparing them with superficial tillage farms to determine which ones have the most positive effect on yields. The importance of the study is based on the fact that it is based on field data collected in personal interviews with the agricultural producers. It

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also examines the problem of a major strategic crop for the producer and the consumer.

### Materials and Methods

1. In July, a sample of wheat producers was conducted in Diyala governorate. The number of producers (82 products), which is two groups (41 producers), deep plowing 20-30 cm using a plow, the second group (41 producers) 15-20 cm using a disc plow.

2. After the questionnaire was completed, the data were classified in tables and statistical analysis was carried out using (Excel and Evieos).

### Quantitative analysis the studied samples

Production function : A mathematical relationship that describes the rate at which the resources of production are used to convert them into product . The simplest forms of output function that link a variable output resources to output are the following form: (Abu Shawer and others. 2011.P.139)

$$Y = f(X_1, X_2, X_3 \dots X_n)$$

In order to achieve the overall elasticity of the production, the productive function was used in the form of Cup -Dogalas for easy conversion into linear form by putting the function in logarithmic form (Debertin, 2012. p.171). The function of Cup -Dogalas can be written as follows:

$$Y = A K^{b_2} L^{b_1}$$

The output (Y), the dependent variable, the labor resource (L) and the capital resource (K) were chosen as independent variables for the production function Cup Duogalas.

Y = output quantity/ton

K = Capital invested during the season/\$

L = Labor costs during the season / \$

b<sub>1</sub> = Elasticity of production of capital resource

b<sub>2</sub> = Elasticity of production of labor resource

The labor resource included the costs of the crop service operations from the beginning until the harvest, measured in dollars. The capital resource included the money invested during the agricultural season, in addition to the cost of the destruction of agricultural machinery and equipment, buildings, rivers, water ways, farm roads, land rents also measured in dollars.

### First the function of producing deep-tilled wheat farms

$$\ln(Y) = 0.57460 - 0.001993 \ln(K) + 0.0052828 \ln(L)$$

### Statistical and econometric analysis

The estimated parameters were determined by (t-test) at a significant level of (0.10) where the estimated value was greater than the tabular value and the (F test) showed the significance of the whole function at a significance of (0.05) and its value was (151.4). The R<sup>2</sup> (0.899) confirmed that 89% of the changes in production were caused by the inputs, the remaining 14% is due to other factors that have not been measured by function. The (D.W) test also showed that there is auto correlation problem between the residues which reached (1.537) for the level of significance (0.01) and degrees of freedom (K = 2). It is confined between (du < DW < 4 - du) where it is greater than the value of (du = 1.48) and less than (4-du = value of 2.52), When this rule is achieved, there is no problem of auto correlation problem among the residues. (Bakheet and Fathallah, 2006). As showed by (the Park test) which included estimation the regression equation of the error squar (ei)<sup>2</sup> as a dependent variable and the production (Y) as an independent variable, There is no (heterogeneousasticity) phenomenon the function is as follows:

$$\text{Log}(ei)^2 = 0.53697364683 - 0.00138548318188 \text{Log}(Y)$$

$$t(1.218806) (-0.297605)$$

$$R^2 = 0.002266 \quad F = (0.088569)$$

The results of the estimated function were not significant below the acceptable levels according to the (F test), this indicates that there is no problem of (heterogeneity) of variance, which usually appears in the cross section data.

### Production function of wheat farms with surface tillage

$$\ln(Y) = 3.394 + 0.1260 \ln(L) + 1.073 \ln(K)$$

### Statistical and econometrics analysis

The estimated parameters were determined by (t-test) at a significant level of (0.50 and 0.25) where the estimated value was greater than the tabular value , and the (F test) showed the significance of the whole function at a significance of (0.05) and its value was (411.52). The R<sup>2</sup> (0.959) confirmed that 95% of the changes in production were caused by the inputs , the remaining 5% is due to other factors that have not been measured by function. The (D.W) test also showed that there is outo correlation problem between the residues which reached (1.621) for the level of significance (0.01) and degrees of freedom (K = 2). It is confined between (du < DW < 4 - du) where it is greater than the value of (du = 1.48) and less than (4-du = value of 2.52), When this rule is

**Table 1:** Determination of the studied samples of wheat farms in Diyala\2019.

S	Characteristics of the studied samples	The details
1	Number of wheat producer in Diyala	Total number producers : 110000
		Number of sample producers: 82
2	Wheat areas in Diyala governorate	Total areas : 93420 Hectare
		Total sample area : 1985.5 Hectare
3	Type of soil for studied farms	Reclaimed heavy soil : 91%
		Light soil : 9%
4	Quality tillage and plow type for the studied sample	Surface plowing (15-20 cm) using a disc plow : 50%
		Deep plowing (20 – 30 cm ) using a plow plow : 50%
5	Cultivated cultivars of the studied sample	Category (ADNA) : 41% from sample
		Category (IIBAA 99) : 39% from sample
		Category (BORA) : 14% from sample
		Category (JYHAN) : 6% from sample
6	Owning farm records	They have farm records : 14% from sample
		They do not have farm records : 86% from sample

\*Reference: Iraqi Ministry of Agriculture. 2019. \*Researcher : based on questionnaire.

**Table 2:** Parameters of the estimated productivity function (deep tillage farms).

Estimated function parameters	
Y(t)	0.5746085(1.446762)*
K(t)	-0.001993 (-2.586056)*
L(t)	0.005282 (8.06)*
R <sup>2</sup> Adjusted R	(0.899)(0.893)
F	(151.4)**
D.Wdu= (1.42)	(1.537)***

\*Significant level 0.10 \*\* Significant level 0.05

\*\*\* Significant level 0.01

achieved, there is no problem of outo correlation problem among the residues. (Bakheet and Fathallah, Previous reference). As showed by (the Park test) which included estimation the regression equation of the error squar (ei)<sup>2</sup> as a dependent variable and the production (Y) as an independent variable, There is no (heterogeneousasticity) phenomenon the function is as follows:

$$\text{Log}(ei)^2 = 3.666086422 - 0.00187521303126 \text{Log}(Y)$$

$$t(-16.34549) (1.007637)$$

$$R^2 = 0.025374 F = (0.319840)$$

The results of the estimated function were not significant below the acceptable levels according to the (F test), this indicates that there is no problem of (heterogeneity) of variance, which usually appears in the cross section data.

**Economic analysis of the estimated production function**

A Cup -Douglas function can be written in exponential form as follows:

**Table 3:** Parameters of the estimated productivity function (farms with surface tillage).

Estimated function parameters	
Y(t)	3.394 (9.200455)**
L(t)	0.1260 (1.0009)*
K(t)	1.073 (10.229)**
R <sup>2</sup> Adjusted R	0.959 0.956
F	(411.52)**
D.Wdu= (1.48)	(1.621)***

\*Significant level 0.25 \*\* Significant level 0.05

\*\*\* Significant level 0.01

Production function of deep-tilled wheat farms:

$$Y = 0.57460 K^{-0.001993} L^{0.0052828}$$

Production function of wheat farms with surface tillage:

$$Y = 3.39464 K^{1.073224} L^{0.1260034}$$

The deep-tilled plantation is illustrated by the production function Cup -Douglas the productive elasticity of the labor resource is positive, while the capital resource with a negative sign means that optimization is not achieved in the production process. The capital resource is used in the third stage of the low yield law, a stage production decline total output (Debertin. 2012. P.35). As for the function production of wheat farms with surface tillage, where the elasticities of the production inputs were positive signals, the production of these inputs was in the second stage of the law of decreasing yield. In the second stage, the total output reaches its maximum limit, which means the possibility of profit for the product as long as there is a response to the addition of units of input production and add to the total revenue more than add to the total costs (Abu Shower and others 2011. P.

137). (L. Martin Rueda and other 2007. Pp1 -9) concluded that the plowing depth (0-15 cm) leads to a (17%) increase in yield and the plowing level (15-30cm) production increases by (75%). In a research experiment conducted by (Shokoofeh and others, 2018) for three different plowing levels of wheat yield, it was concluded that surface tillage yields higher yields than other tillage systems and does not deplete large quantities of irrigation water into the soil. (Taner and others, 2015) concluded that an experiment using two types of machinery (disc plow and plow plow) concluded that the plowing system (surface tillage) is the most efficient in agricultural production in terms of yield increase and production costs. When the quantity of labor and capital on the farm is consistent, the increase in production and profits on the farm can be done by organizing and streamlining farm labor and efficiently managing these resources. (Samurai, 2008. P. 238). (Tamimi. 2018) concluded that the use of fertilized fertilizer technology, and the use of effective pesticides cause increased yield if used in a timely manner and in recommended quantities.

### Conclusions

1- 39% of the producers of the studied sample used the seeds of low production and without knowledge because of the lack of awareness and 86% of the producers of the sample studied do not have farm records, making it difficult for them to calculate the costs and profits and record differences between seasons.

2- The production function showed that the surface tillage (15-20 cm) achieves the optimal combination of the productive inputs where the elasticity of the positive signal and it reduces the cost of production as it is done by the disc plow and at the same time reduce the excessive water irrigation.

3- The production function of the farms of the sample with deep tillage (20-30 cm) did not achieve the optimal combination of production inputs, which means that it increase the volume of costs.

#### Recommendation

1- Follow the system of surface tillage (15-20 cm) using the plow disk for the reclaimed land, where high yield and reduce production costs and reduce the drain of irrigation water and labor efforts.

2- Use of improved seeds with high productivity and resistance to salinity and disease and the adoption of a

system of diversity in crop cultivation to preserve the natural forces of soil and recommends the study of the need to have agricultural product agricultural records to know the differences between season and another and know the size of costs and profits.

### References

- Abu Shawar, Munir and Musaedh, amjd abd almahdiy and Eaqilah, mahmud yusf (2011). Introduction to the agricultural economy. Library of the Arab Society for publication and distribution. Amman - Jordan. Pp. 137-138. (*in arabic*).
- Bakhit, Hussein Ali and Fathallah, Sahar (2006). Econometrics. Al Yazuri Press - Jordan. Pp. 88-291. (*in arabic*).
- Directorate of Agriculture Govenorate of Diyala (2019). Computer outputs of the 2019 agricultural plan. Department of Planning and Follow-up - Iraqi Ministry of Agriculture. The Republic of Iraq. (*in arabic*).
- Debertin, Davidl (2012). Agricultural production economics, Macmillan publishing pany, London. P 35-171.
- General Authority for Extension and Agricultural Cooperation (2011). Technology of growing wheat. Iraqi Ministry of Agriculture. The Republic of Iraq. Guidance Bulletin. P. 11. (*in arabic*).
- Khorami, Shokoofeh Sarikhani and Kazemeini, Seyed Abdolreza and Afzalinea, Sadegh and Gathala, Mahesh Kumar (2018). Changes in Soil Properties and productivity under Different Tillage Practices and Whwat Genotypes A Short -Term Study in Iran. Shiraz University, Shiraz, Iran. *Sustainability Journal*, **10**: 3273.
- L. Martin Rueda, L.M. Munoz Guerra, F. Yunta, E. Esteban, J.L. Tenorio and J.J. Lucena (2007). Tillage and rotation effects on barley yield and soil nutrients on Calciortidic Haploxeralf. *Soil and Tillage Research*, **92**: Pp1-9.
- Samurai, Hashim Alwan (2008). Agricultural Business Administration. Al Yazuri Press. Oman -Jourdan. P. 238. (*in arabic*).
- Al-Tamimi, Abbas A.A. (2018). Economic analysis of the cost and production function of the impact of the use of the national wheat development program in Diyala Governorate for the production season 2017-2018. *Journal of the Euphrates for Agricultural Sciences*, **10(4)**: (*in arabic*).
- Taner, Alpe R. and Arýsoy, Rifat Zafer and Kaya, Yasin and Gültekin, Ýrfan and Partigöç, Fevzi (2015). The effects of various tillage systems on Grain yield , Qualty parameters and energy indices in winter Wheat productio nunder the ainfed conditions. University of Ondokuz, Samsun, Turkey. *Fresenius Environmental Bulletin*, **24(4)**: