http://dx.doi.org/10.22161/ijeab/3.2.21 *ISSN: 2456- 1878*

Evaluation the Performance Efficiency of Manufactured, Modified and Assembled Combine Implement and Studying It's Impact on Some Soil Physical Properties and Total Costs

Abdulrazzak A. Jasim, Osama H. Jwer

Prof. PhD. Ag. Eng. , Dept. of Agric. Machines and Equipment /Coll. of Agriculture/ Univ. of Baghdad, Iraq

Abstract— *The experiment was conducted to evaluate the efficiency performance of the combine implement which manufactured and assembled locally and studying it's effect on some soil physical properties and total costs in one of the Agricultural College University of Baghdad Experimental Fields in loamy soil, 2017. Brazilian Massy Ferguson Tractor (MF-650) was used with the combine implement as a machinery unit. Three machinery unit speeds included 3.15, 4.60 and 6.10 km/h and seedling treatments included manufactured combine implement, seedling and fertilizer implement and manual seedling were used in this experiment. Soil bulk density, soil moisture content, amount of added water and total costs were measured. Nested design under randomized complete block design with three replications was used in this experiment. Least significant differences (LSD = 0.05) level under 0.05 probability was used to compare treatment means.*

The results can be summarized as following:

1. *Incrased machinery unit speeds from 3.15 to 4.60 km.h^{-1} led to significant increase in soil bulk density from 1.30 to 1.36 Mg.$m^{-3}$and significant increase in soil moisture content from 0.18 to 0.20 %.*
2. *Manufactured combine implement treatment was superior in getting less soil bulk density stood 1.22 Mg.m^{-3} higher soil moisture content stood 0.22%.and less amount of added water during the season stood 1103.43 mm. and less costs stood 796370 Iraqi Dinars.*
3. *The interaction between 3.15 km.h^{-1}machinery speed and manufactured combine implement got less soil bulk density stood 1.19 Mg.m^{-3}, while the interference between 6.1 km.h^{-1} machinery unit speed and manufactured equipment was superior in obtaining a higher moisture content* **stood** *0.229%.*
4. *Using the locally manufacturing modified combine implement for primary and secondary tillage, shallow furrow opener, seedling and fertilization in one time was successfully done in this study with high performance efficiency.*

Keywords— ***performance efficiency, combine implement, shallow furrow opener, seedling, and fertilization.***

I. INTRODUCTION

Agricultural mechanization is one of the main indicators of the transition from traditional agriculture to modern agriculture. Agricultural mechanization plays a fundamental and effective role, especially if it is scientifically exploited. The international experience of developed countries and local experiences proves that agricultural mechanization is of great importance in increasing production, reducing costs and reducing working hours, where agricultural mechanization performs various agricultural operations by means of mechanical equipment, which is dependent on the mechanical or electrical driving ability using the lowest human or animal effort.

There are many combine equipment designed for the development of tillage and most of these equipment are used in primary and secondary tillage and machinery service crop and control of the bushes, seeds and fertilization, and these equipment are becoming more common because they work more than one process during the passage of one and this will reduce the number of traffic in the field, The remains of plants and their formation on the surface of the soil instead of burying them, and thus they fit very well towards the trend of reducing tillage or conservation of tillage, Frank, et, al, (2012).

http://dx.doi.org/10.22161/ijeab/3.2.21 ISSN: 2456- 1878

Lack of irrigation water supply due to climate change, low water and river water levels and moisture of water distribution have forced many farmers in Iraq to abandon agriculture. Some farmers have used groundwater to irrigate crops, reducing water levels and becoming poor quality due to increased salinity, and because of high pumping costs and low water table, farmers were forced to use water in a rotation manner. Therefore, alternative methods were used, one of which was to practice water deficit, which will lead to further expansion of horizontal agriculture for the same water resource, thus increasing the efficiency of water absorption that can lead to food security and reduce the risk of desertification.

The seeds of the agricultural machinery for planting the seeds, where the use of seed implements yielded positive results in the speed of completion of the seed and not waste in the quantities of seed used as the use in accordance with the design task has the ability to distribute seeds in the field on a regular basis and cover the seeds in the soil after the process Seeds and prevent their being eaten by birds. Fertilizer can also be distributed at the same time as seed when using seedling and fertilizers, (Ali, 1989).

The process of fertilization has a key role in the soil where the soil needs to replenish its fertility and compensate for the loss of elements of the addition of animal or chemical fertilizers and to reduce the persistence of the stress of erosion and decrease of nutrients, especially the basic materials such as nitrogen, phosphorus and potassium. This is done using special equipment for fertilization and varies depending on the type and nature of fertilizer, (Hassen and Ezzet, 1987).The fertilization process also has a high economic success if it is used to increase agricultural production when using fertilization equipment. Similarity is similar to that of the seed equipment, and the equipment used for sowing and fertilization is used in one,(Al-Tahan and Al-Naama, 2000).

According to the importance of choosing the best irrigation methods, irrigation interval and potato planting methods for potato planting, this experiment was done.

II. MATERIALS AND METHODS OF WORK

A field experiment was conducted in one of the fields of the Faculty of Agriculture / University of Baghdad / Al-Jadriya for the agricultural season 2016 2017. To evaluate the performanle efficiency of a combined implements used f primary and secondary tillage, opening shallow farrows and seedling, fertilization and its studying on the some soil siel properties total costs.. Then the primary tillage was carried out by the three-piece trowel plow. Then the secondary tillage was softened by the rotary plow. (18) experimental units, which are included in the comparison with the experimental units of the machine manufactured (9) experimental units, the soil samples were taken from each experimental unit in the field randomly from different locations and at a depth (0-30) cm and classified soil tissue as Soil Incubation, Table (1)

Table.1: Some physical and chemical properties of the soil

Adjective.			Unit		Value
(Electrical conductivity EC)			$ds.m^{-1}$		1.2
(pH) degree			.....		7.35
Soil particles analysis			Sand	G. Kg^{-1}	438
			Silts		394
			Clay		168
Type of soil			Silt soil		
Soil penetration resistance			Kilo Pascal		3
(som) Organic matter of soil			G. Kg $^{1-}$		7.65
Bulk Density			$^{3-}$m. Makagram		1.312
(N) Nitrogen			%		0.018
Nitrogen Ready / Ion Ammonium			Kg $^{1-}$.Ml gN		20.92
Moisture content under pressure	⅓field capacity	bar	%		0.335
	15welting point				0.114

The combine implement which manufacturing modified and assembling locally consists of included sweep plow, rotary plow, seedling implement, fertilization and open shallow furrows,:

1. compine implement, (Sweep plow), one of the parts of the compine implement is installed in the front part of the implement leads the pramary tillage and prepares the soil to the secondary tillage, linked to the structure of the compine implement and consists of two shares each shares is linked to a height of 70 cm and width of 10 cm and thickness of 3 cm and From the bottom V-shaped shares in English and consists of two wings have a nose for the weapon with a thickness of 4 cm convex height of 10 cm and

two fins back the distance between 25 cm and the length of each alone 50 cm.

2. Rotary plow, used for soil pulverization (secondary tillage) soften and prepare for the soil other stage of opening the cane, the working width of the 160 cm contain 17 teeth teeth successive around the axis The tooth, which is derived from the PTO shaft, has a length of 22 cm and its thickness is pointed to the front to facilitate penetration of the soil.
3. Seedling implement, it is the third part of the combine implement and lead the process of mechanical seedling, which regulates the placement of seeds in the shrine of the seed and reduce the loss of seeds and reduce the eating of birds, and consists of the structure and seed reservoir and transmission pipes seeds and the mechanism of feeding and glass
4. Fertilization imp, the fourth part of the machine which is working on the distribution of manure mechanically and in a systematic flow and has an effective role in the removal of manure in the bottom of the plantation through pipes laid out in a regular manner and divided by equal distances, consisting of fertilizer from the structure and from the fertilization tank and fertilizer feeder and landing tubes Compost and chicken.
5. Shallow farrow opening implement, the fifth and final part of the machine which is working to open shallow nodules (grooves) and have an effective role in saving water proportion of two thirds of water and one third of land and agriculture on the rice gives ventilation of the plant and the return on the entry of light and strengthen roots, The machine to open the shallow mulch of the structure and four crumbs Each glass containing the weapon of the man of the duck works on opening a loose maze. Working machine mounted,

This combine implement is planting the corn seeds at the top two thirds of the furrow shoulder of the corn and the process of fertilization on the bottom of the furrow plant, and this implement is characterized by the ability to seed and fertilization and control the depth of the plant and any height and have the ability to horizontal movement (Figure 1) shows the work of the machine as shown in Fig. (2)

Fig.1: front view of the combine implement

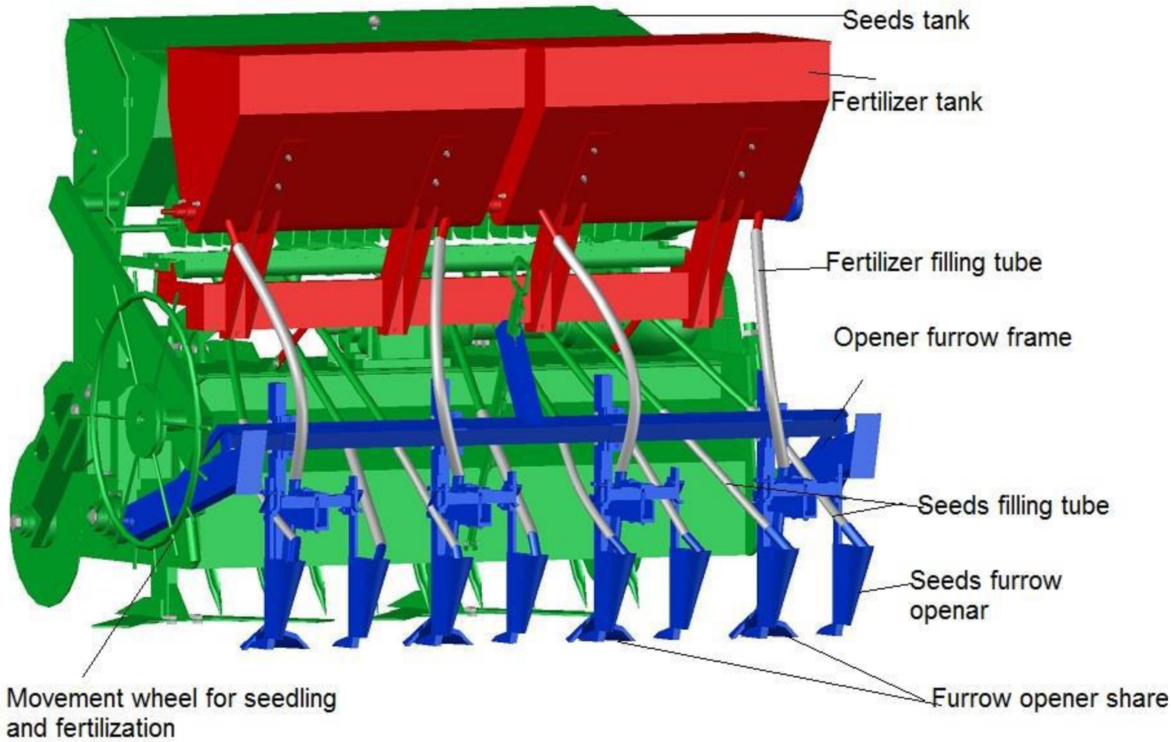

Fig.2: Rear of the machine

Studied Properties

1- :Pulk density of Soil, Mg.m^{-3}

Pulk density was calculated by the method of the Core Method cylinder at the end of the agricultural season using the following equation proposed by, Black and Hartage (1986)

Pp=Ms/ Vt Mg.m^{-3}

Whereas:-

Pb = Pulk density, (1 µg.m^{-1})

Ms = mass of dry sample, (1 µg m)

Vt = sample size, (m^{3})

2- Soil Moisture Content measurement (%)

The moisture content was calculated by the weight method prior to conducting the experiment and for each experimental unit as stated in, Hassan , (1990). and according to the following equation

M = (Mw / Ms) x 100

Whereas:-

(%) M = Moisture Content

Mw = Mass of Water, (grams)

) Ms = Solid block Mass, (gram

3-Amount of irrigation water added,

Shows the amount of water discharged per irrigation. The added water depth was calculated using the proposed equation proposed by, Kovda .et. al (1973).

d = (ΘFC - Θw) D

whereas

d = depth of added water, (cm)

ΘFC= Volumetric humidity at field capacity (cm-3 cm)

Θw = Volumetric humidity before irrigation 60-65% of the ready water, (cm. cm-3)

D = Depth of irrigated root zone, (cm)

The content of the prepared water is determined by the difference between the volumetric content at a water pressure of 33 kPa which shows the field capacity and the volumetric content at 1500 kPa which shows the permanent wilting point according to the following equation.

whereas:

$$A_W = \theta_{fc} - \theta_{wp}$$

Prepared water content in soil, (cm ^{3} cm^{-3}= A_W)

= θ_{fc} (Volumetric content at field capacity, (cm^{3} cm^{-3})

Volumetric content at the permanent wilting point

θ_{wp} = (cm^{3}cm^{-3})

4-Total Costs, ID

The total fixed and variable costs have been calculated in accordanceto the approved economic criteria and the comparison of the transactions and the calculation of the annual revenues and profits .

http://dx.doi.org/10.22161/ijeab/3.2.21 ISSN: 2456- 1878

III. RESULTS AND DISCUSSION

1-Soil Bulk density, Mica gm.m^{-1}

Table (2) shows the effect of the practical velocity of the mechanic unit and seedling coefficients and their overlap in the bulk density. Table (2) shows that the increase in the operating speed from 3.15 to 4.6 and then to 6.10 cm. led to increase bulkdensity from 1.30 to 1.33 and then to 1.36 mica gm. M^{-3}. The reason is that the increase in speed helps increase the fragmentation of the soil and work on the formation of small minutes that fill the pores and over time and at the end of the agricultural season and the result of moisturizing and drying less size And increase its mass and lead to an increase in the bulk density, and with the results which proposd by of, AL-Jubouri, (2012) and Al-Sharifi, (2009).

The results indicated in Table (2) that the seed treatments had a significant effect on the soil density of the soil, where the treatment of the seedling combine implement was less apparent soil density of 1.22 µg .while while the fertilizer and fertilizer treatment recorded the highest soil bulk density of 1.41 µg.

Table (2) shows the effect of the interaction between the mechanical speed of the mechinary unit and the seedling treatments on the bulkdensity. The binary interaction between the practical speed exceeded 3.15 km.-1 and the processing of the manufactured machine obtained the lowest bulk density stood 1.19 µg.¯,, The value of the virtual density was between the speed of the operation 6.1 km.S1 - and the treatment of the fertilizer and fertilizers and amounted to 1.44 µg..¯.

Table.2: Effect of Machinary speeds and seedling treatments on soil bulk density, Micagram. m^{-3}

Soil bulk density, Mica gm .m^{-3}				
Speedkm.h^{-1}	Seed treatments			Average speed
	manufactured combine implement	seeding and fertilizer implement	manual seedling	
3.15	1.193	1.397	1.336	1.309
4.60	1.252	1.403	1.353	1.336
6.10	1.242	1.444	1.401	1.362
LSD	0.02217			0.00897
Average	1.229	1.415	1.363	
LSD	0.015			

2-Moisture content of soil(%)

Shows that the increase in process speed from 3.15 to 4.6 and then to 6.10 cm^{-1}, has had a significant effect on the soil and soil moisture content. Increase the moisture content of the soil from 0.188 to 0.202 and then to 0.208 on the relay. This is because the increase in the speed of the process helps to increase the extrusion of dust blocks and increase the degree of fragmentation of the soil, which increases the filtration or water condensation into the soil increases the moisture content of the soil , And these results correspond to the results obtained by,AL-Janabi, (2000).

The results indicated in Table (3) that the seed plant has a significant effect on the moisture content of the soil, where the treatment of the processed machine recorded the highest percentage of moisture content of 0.22%, while the treatment of the fertilizer and fertilizer was the lowest proportion of moisture content amounted to 0.182%, and may be due to the machine was used The primary tillage plow, the rotary spindle in the softening and the shallow root groove, all of which help to retain moisture in the soil with very little evaporation, which increased the moisture content of the soil compared to the two laboratories that used the plow, disc harrows and seed in mm lines Evaporation from the soil or the loss of water without the root zone increased.

Table (3) shows the significant effect of the binary interaction between the mechanical speed of the mechanic unit and the seed treatments in the moisture content of the soil. The overlap between the process speed exceeds 6.1 km .1 and the processed machine is treated with the highest soil moisture content of 0.299% Of the moisture content of the soil was between the practical speed of 3.15 km.sa^{-1}, and the treatment of alfalfa and fertilizer was 0.171%..

Table.3: Effect of Machinary speeds and seedling treatments onsoil moisture content (%)

Soil moisture content (%)				
Speedkm.h^{-1}	Seed treatments			Average speed
	manufactured combine implement	seeding and fertilizer implement	manual seedling	
3.15	0.2127	0.1717	0.1807	0.1883
4.60	0.2197	0.1927	0.1943	0.2022
6.10	0.229	0.1837	0.214	0.2089
LSD	0.0115			0.00682
Average	0.2204	0.1827	0.1963	
LSD	0.00724			

3-Quantity of water added (water consumed), mm

Table (4) shows the results of the irrigation and the quantity of water added during the planting season of the barley barley yield. The results were obtained after sampling the moisture content at field level 0.33 and at 0.11 wilt points and with depletion of 60-65% of the prepared water before each rye and each unit.

Table (4) shows the results of the quantity of water added to the 7 irrigated wells and the rainwater recorded 4383.24 mm .Table 4 shows the results of total water added to 43177.58 (m3.hkata-1). The results show that in the treatment of the manufactured machine, the recorded water depth and the added water volume were lower than those of the powder and fertilizer and manual propagation by 0.33% The treatment of the manufactured machine was irrigated by 0.67% because it was cultivated on shallow marshes and this is the profitability in water consumption to reduce the phenomenon of water scarcity .

Table.4: Table of the quantity of water added during the planting season

Transaction number	Transactions	Quantity of water added during the season, mm	Volume of water added, M^3.ha^{-1}
1	manufactured combine implement	1103.43	11034.27
2	seeding and fertilizer implement	1595.22	15952.26
3	manual seedling	1619.1	16191.05
	Total transactions	4317.71	43177.37M^3.ha^{-1}
	Amount of rain water during the season	65.5	
	Total final amount of water added during the season	4383.24 mm	

4-Total costs of mechanized unit

The results were indicated after selecting a set of criteria that fit the production process. Comparisons were made between the two transactions. Table (5) The final value of fixed, variable and total costs after calculation of the values of each machine were compared in terms of production and fixed and variable costs

Where the efficiency of the machine manufactured in the final production exceeded the other transactions in obtaining the lowest operating cost amounted to 796370 dinars, due to the entry of the unit mechanic one-time reduced the cost of labor and reduced the rate of fuel consumption and also gave valuable results through saving water by Two thirds of water and one third without the use of shallow barley, and increased production of the crop due to the regularity of agriculture and the lack of soil soil and ventilation and increase moisture content and low density of the apparent and the multiplicity of crop branches and the introduction of solar radiation and ventilation of the plant.

http://dx.doi.org/10.22161/ijeab/3.2.21 ISSN: 2456- 1878

Table (5) shows the total cost of the treatment of fertilizer and fertilizers, which amounted to the highest cost of 1206350 dinars, due to the entry of the unit mechanic 4 times, which led to increased labor wages and increase in fuel consumption and the impact of the entry of machines from pressure on the soil and Dkha and reduce physical properties and increase density Of the soil and reduce the pores, which affects the productivity of the crop and the increase in costs.

Table (5) presents the results of the total costs of manual hand-handling, which amounted to KD 11.1 million. The reason for the irregularity of agriculture, the intensity of the crop and the machine's double-entry when plowing, softening, and the use of labor in machinery, prose, fertilization and non-cover during planting, Make the cost increase

Table.5: Fixed, variable and total costs, Acres^{-1}

Transactions	Fixed costs, D^{-1}	Variable costs, D^{-1}	Total costs, D^{-1}
manufactured combine implement	**517250**	**279120**	**796370**
seeding and fertilizer implement	**572750**	**633600**	**1206350**
manual seedling	**561000**	**550000**	**1110000**

IV. CONCLUSIONS

The results of the research show the following

1. The increase in the speed of the process of agriculture significantly increased the density and the moisture content.
2. The increase in the effect of seed in the treatment of the processed machine has resulted in a significant increase in moisture content, and a significant decrease in the apparent density.
3. The binary interference between the speed of the tractor exceeds 6.1 km. And the treatment of the manufactured machine to obtain the highest moisture content.
4. The interference between the speed of the machine exceeds 3.15 km.-1 and the processing of the manufactured machine in obtaining the least apparent density.
5. The results showed that the treatment of the machine manufactured the least use of water added to use the method of shallow meadows by two thirds of water and one third without water.
6. The processing of the manufactured machine has the lowest total total costs compared with the other transactions.

REFERENCES

[1] Ali, K, M, (1989).Tugs and agricultural equipment. Ministry of Higher Education and Scientific Research, Baghdad University, Faculty of Agriculture, Directorate of Higher Education Press.

[2] AL-Janabi, O, M, R, (2000). Performance of the Massey Forks MF-399 Quadrilateral plow and overlapping with some physical properties of soil Master degree, Department of Agricultural Mechanization - Faculty of Agriculture - University of Baghdad

[3] AL-Jubouri, R, Abdul H, A,.K, Al-Nama, Ali, M, A, (2012).an account Fuel consumption and some New Holland tractor indicators Assistant.Diyala Journal of Agricultural Sciences, 4 (2): 137 - 144, 2012

[4] Al-Sharifi, S, K, A,. (2009), the effect of two types of plows and accelerated different depths in the performance of the unit Almiknyh and some of the physical characteristics of the soil, the University of Babylon Journal, Pure and Applied Science, No. 1, Vol. 17: 182-205.

[5] Al-Tahan, Y, H, and M, J, Al-Naama, (2000).Machineryand agricultural machinery. Ministry of EducationHigher and ScientificResearch, Mosul University, Faculty ofAgriculture and Forestry, Directorate of the Department of BooksFor printing and publishing.

[6] Black , G. R. and H. Hartage 1986. Bulk density, In A. Klute ed. Methods of Soil Analysis, part 1.Agron. Mon. 26: 363-367

[7] Hassan, H, M, (1990). Soil Physics, Directorate of Dar Al Kutub for Printing and Publishing, Mosul University, Ministry of Higher Education and Scientific Research, Iraq.

[8] Hussein, Lotfi and Abdel Salam Mahmoud Ezzat, (1978). Equipment and mechanization of field cropsBaghdad University Press.

[9] Frank , B ,F.Roland, A.H. Thomas and R.C.Keith (2012) Fundamentals of Machine operation, Tillage, john Deer service publication depts, johnDeer road , Moline, Illinois.

[10] Kovda , V. A. ; C. V. anden Berg, and R. M. Hangun 1973. Irrigation Drainage and Salinity , FAO, UNESCO, London.