Tikrit Journal for Agricultural Sciences (TJAS)   Tikrit Journal for Agricultural Sciences (TJAS))   Tikrit Journal for Agricultural Sciences (TJAS)

Adil A. Abdullah *

Mohammed S. Abdul Rahman

Dept. of Agric. Mechanization, Coll. of Agric. & Forestry, Univ. of Mosul.

Comparison Between Local Manufactured Panel Ridge and Conventional Disc Ridge Throughout Investigating Their Effects on Power-Use-Efficiency, Draft Force and Actual Field Productivity

ABSTRACT

Field experiment was conducted to investigate the comparison between two types of ridge (panel and disc) using two spaces between the operational parts (90 and 110 cm) at two speeds (4 and 2.6 km/hr). First stage from this study was to identify the important dimensions to the local manufactured ridge (ridge panel) with selecting the appropriate material throughout series of material, mechanical and chemical analyses. Second stage was to evaluate the performance of this particular manufactured ridge by measuring the effects of this implement on draft force, slippage percentage and power-use-efficiency as well as field performance represented by field productivity, efficiency, and the size of the disturbed soil. Randomized Complete Block Design (split-split plot) was used in this experiment to find out the effects of the studied factors on the indications that mentioned above. The results have shown that the local manufactured panel ridge (LMPR) was significantly higher than the Conventional Disc Ridge (CDR) (P<0.05) in terms of power and performance efficiency. First speed (4 km/hr) was also significant by recording higher values for draft force, practical field productivity and the volume of disturbed soil compared with 2.6 km/hr. The wider distance between the operational parts (110 cm) was significantly higher in terms of practical field productivity and the volume of the disturbed soil compared with the smaller distance 90 cm (P<0.05), however, 90 cm recorded higher efficiency performance. The interaction between speed and the distance between the operational parts was also significant (P<0.05), where 2.6 km/hr with 110 cm recorded higher slippage percentage, and speed 4 km/hr resulted higher field productivity and disturbed soil when interacted with 110 cm distance. It is also found that all interactions between speeds, the types of ridge, the interactions between distance and the type of ridges were significantly effect on the power and performance indications. Where the local manufactured ridge at these speeds and distances was significantly better compared with the disc ridge through recording higher values for the power-use-efficiency (PUE), practical field productivity, performance-efficiency and the volume of the disturbed soil. The interaction between the three studied factors was also significant (P<0.05), where manufactured ridge recorded higher values compared with the disc ridge in terms of all investigated indications.

---

* *Corresponding author: E-mail*: **Adelwt8@gmil.com**

INTRODUCTION

The ridge is a special construction equipment that follows the primary and secondary equipment, which requires the preparation of the land for agriculture in special conditions and attention to the design factors in the evaluation of special construction equipment in different soil conditions and the manner of movement in these soils. The work of the ridge is contrary to the work of the lister (middlebusters) and ditcher, which collects the side soil as it passes in the field to accumulate in the form of high in the center called the ridge (Al- Banna 1990), It is attached to agricultural equipment for the cultivation of tuber crops, such as potatoes, as it works to cover cultivated seeds and fix them in the soil above the cultivation line (Hussein and Ezzat 1978), and process of ridge requires that the soil be well plowed , softener and the direction of the line ridge is orthogonal to the tillage processes to obtain a homogeneous distribution of soil and reduce the probability of collapse of the ridge (Bernik et al. 2009). This equipment is responsible for a significant proportion of the energy consumed in the process of special transactions and the resulting quality of work (Vucajnk et al. 2012).Vander and Beukema(1990) concluded that the crawling motion of the ridge panel and with the help of the panels works to achieve a tangential link between the board and the soil together along the board, which requires greater pulling force and thus greater drawbar power,While the rotational movement of the ridge disc generates a centrifugal force leading to the expulsion and dispersal of the soil, which causes the shortage of cohesion of grains of soil and the disk does not touch the soil at only one point, which reduces the strength of pulling force and thus reduce the drawbar power. Aday et al. (2001) and AL-Jalil et al.(2001) indicated that increasing the forward speed of the mechanic unit with increasing the distance between the plow shears increased the requirements of pull force and specific resistance. Stated Hunt (1995) stated that the slippage wheel of the tractor is increased by increasing drawbar power when the forward speed is stable, and increasing slippage causes reduce tractive efficiency, as the depth achieved by the machine is one of the factors affecting slippage wheel of the tractor, as the increase in depth is accompanied by an increase in the slipping percentage due to increased pulling force. Al-Zubaidi (2004) confirmed that the special equipment and the leveling machines are working to compact the soil through direct contact with it. This contact increases the friction between the surface of the soil and the surface of the working part, which leads increases the pulling force and thus increases slipping percentage. Sud (1986) observed that the energy used in the ridge panel is greater than the energy used in ridge disc because the ridge panel works to absorb the soil more and thus increase Exploitation of energy. , Amin (1990) found a study on the requirements of ridge machine for energy and efficiency in the formation of ridges that the ridge panel exceeds the ridge disc in recording the highest energy utilization efficiency of 120 % and 180% and for all the forward speeds and all the distances between the working parts tested. Sheikha (1988) compared the tractors with similar horsepower capacities in terms of productivity, The productivity can be exploited either by increasing the width of the working machine or by increasing the speed of completion of the agricultural process taking into account the different farms. Baabeer and Wohbi (1994) noted that the practical speed of the tractor increases the field efficiency rate and this depends on the skill of the operator, the nature of the field and the type of machine used. Bengough et al. (1997) noted during a study on the coverage of a particular type of potato tubers by concave ridge, and found that the productivity of ridge means the rate of performance and depends on the rate of performance of the ridge on the type of wheat and also on the supply of effective work has achieved the ridge panel in light of the high efficiency in covering potato tubers. Tsimba et al. (2002) also added that field productivity depends largely on actual time and actual operational width, field productivity is proportional to speed and operational width, if increased, field productivity increases. Dahab et al. (2002) stated that during a study on the effect of potato tuber cover on root growth, demonstrated using ridge panel, the increase in the speed has led to an increase in field productivity. This increase also has an impact on the efficiency of performance, which has caused it to increase. Sharma et al. (1993) studied the effect of type diger on soil distribution volume, where the superiority of the ridge panel on the ridge disc significantly higher by recording the highest soil distribution volume (503,15)m^3/hr due to the actual width of the ridge panel is greater than the

ridge disc, which affects the increase in the size of a larger soil segment compared to the ridge disc. Canqui and Lai (2009) found thatwhen they studied the effect of tillage before the formation of ridges or furrows on increasing soil distribution volume, Using the plowing disc plow in the process of plowing soil and soften them before entering of ridge panel and ridge disc where they noted that the response of ridge panel to the soil tillage was more than the response of the ridge disc by recording the highest soil distribution volume, this is due to the plates in ridge panel with their straight motion and the angle lap are working on the lap of the largest amount of soil that constituent ridges which caused the highest soil distribution volume. The research objectives were to (1) compare between local manufactured panel ridge and conventional disc ridge throughout investigate their effects on power-use-efficiency (PUE) and practical field productivity, and (2) develop a set of practical recommendations to improve PUE and farm productivity.

MATERIAL AND METHODS

The experiment was conducted at the agricultural station located in Hamaydat -Al-Masaed region, Northern Mosul. The topography of the field was flat, and the soil texture of the experimental field was clay loam, (sand 27.9%, loam 38.7% and clay 33.4%).Tractor type Antar size 81 model 1986 engine four-cylinder and 70 hp was used in the search, moldboard plow with a mass 290 kg and a working width 82 cm utilized, for tillage and a regular harrows operated width 152 cm 16 discs diameter 56 cm was used. Ridge disc 220 kg, width 120cm, two-disc diameter of 7 cm and concavity 11 cm and local manufactured ridge panel (made by Mosul Mechanical Industry) were tested in this work. A metal of the manufactured ridge panel was tested in the Technical Institute - Metals Department. Furthermore, Table 1 shown the the chemical composition and mechanical properties of ridge panel Table 1. Figures 1, 2, 3, 4, 5 and 6 demonstrated the design dimensions of ridge panel parts used in this study, and Figure 7 shown a conventional ridge disc. Field experiment was divided according to the design of the Randomized Complete Block Design (RCBD) Split-Split Plot (Daoud and Elias 1990), where the three factors were investigated in this experiment including speed (2.6 and 4 km /hr), the distance between the working parts (90 and 110 cm) and the types of ridge (local manufactured ridge panel and conventional ridge disc). The data analyses were conducted based on the importance of the factors, which were as follows: type of ridge, distances between the working parts and forward speed. Duncan test was utilized to compare between the means to find significant differences at the probability level (0.05*) and (0.01**). Soil moisture content and bulk density were measured before conducting experiment, and their results were 9.62 % and 1.35 g/cm^3, respectively. Soil bulk density was also measured after conducting the experiment, which resulted 1.21g/cm^3 and 1.09g/cm^3, for local manufactured panel ridge and conventional disc ridge, respectively.

Table (1) Chemical composition and mechanical properties of metal processing ridge panel Used in the study

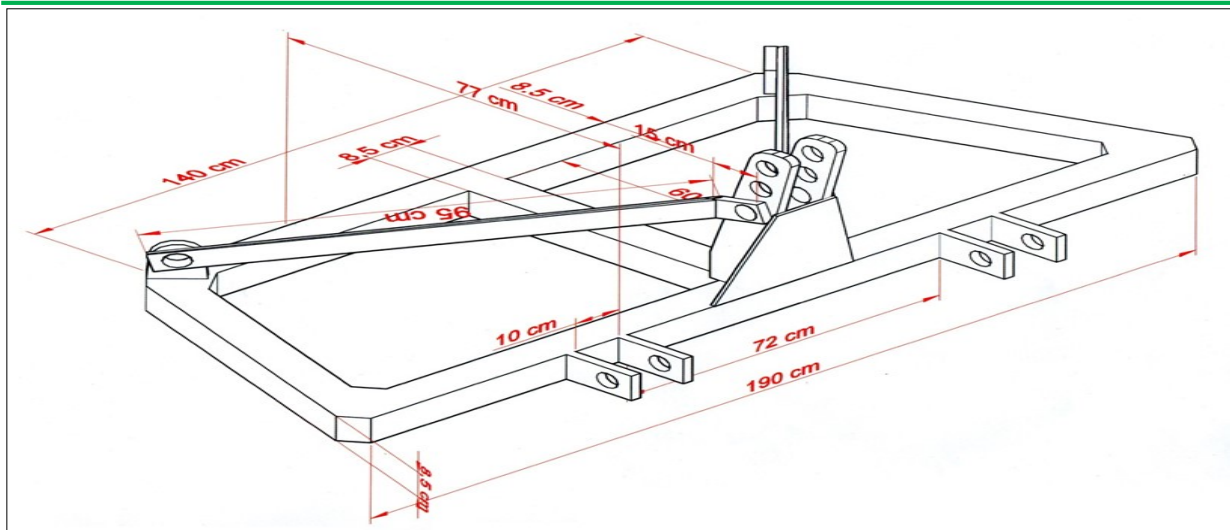|	Chemical composition						Mechanical properties			
Sample	Type of metal AISI	C (%)	Mn (%)	Fe (%)	P (%)	S (%)	Hardness HRA	Maximum tensile strength (N / mm^2)	Contraction stress (N / mm^2)	Elongation%
Plates, share and mounting brackets	1022	0.24	0.3	99.39	0.03	0.04	44	430	258	15.3
frame	1022	0.22	0.41	99.03	0.03	0.04	45	453	272	14.1

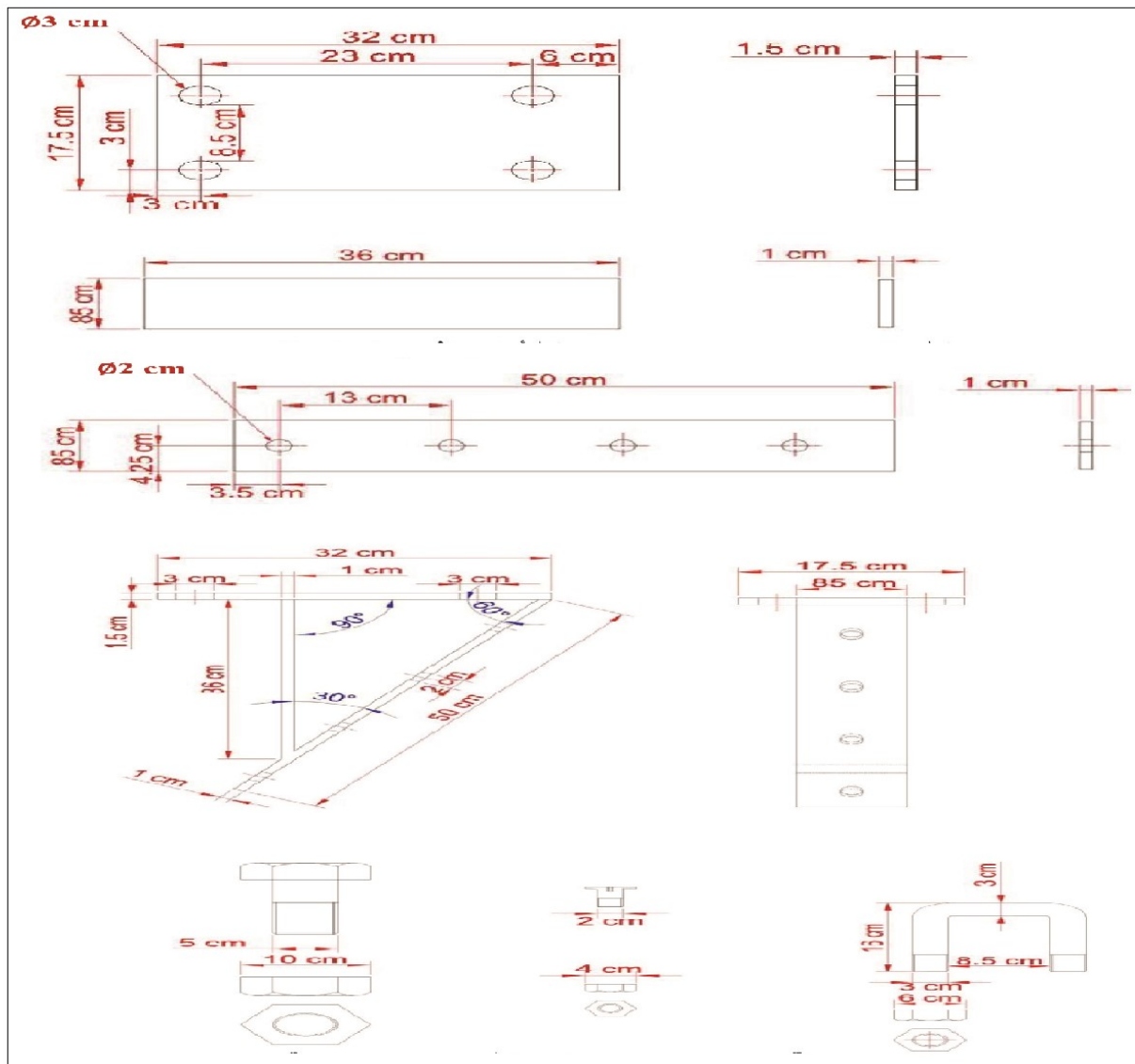**Fig. (1) The design model of ridge panel frame**

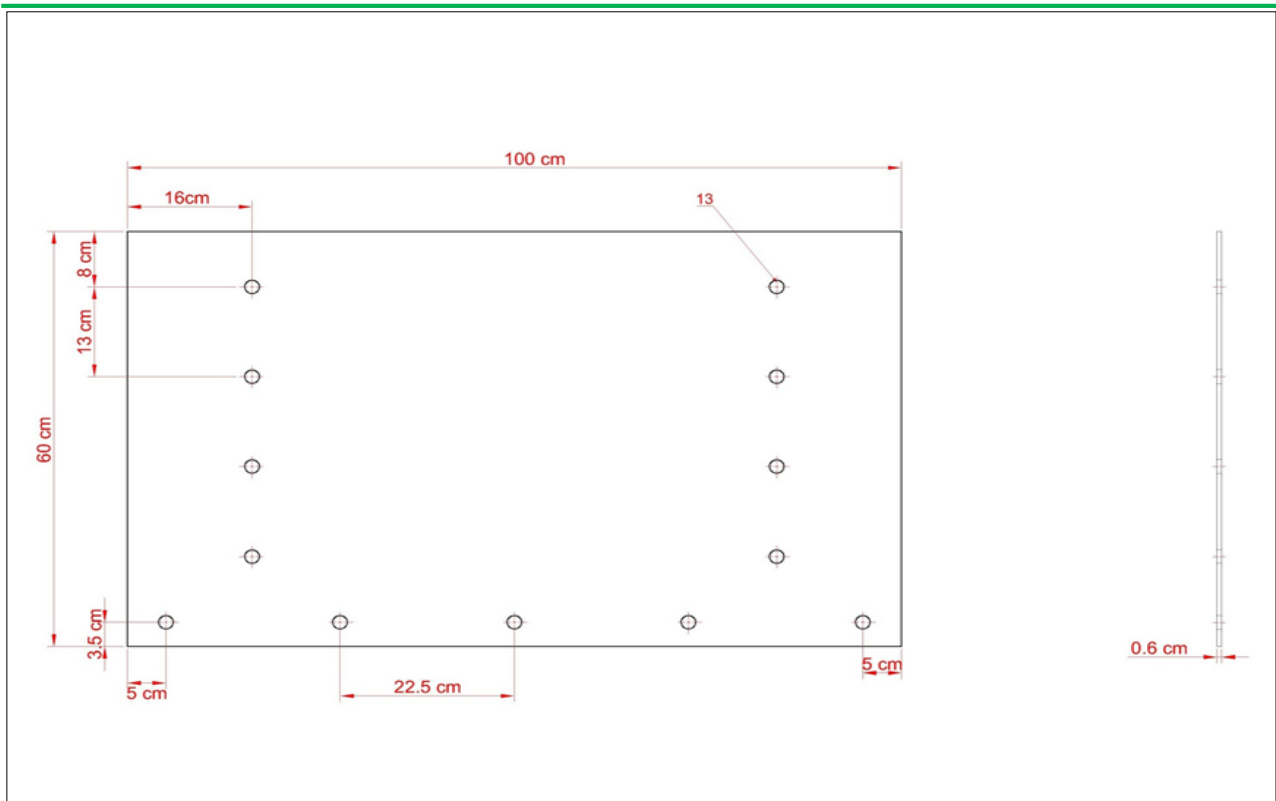**Fig. (2) The design model of the panel mounting substrates in ridge panel**

Fig. (3) The design model of the tablet in ridge panel
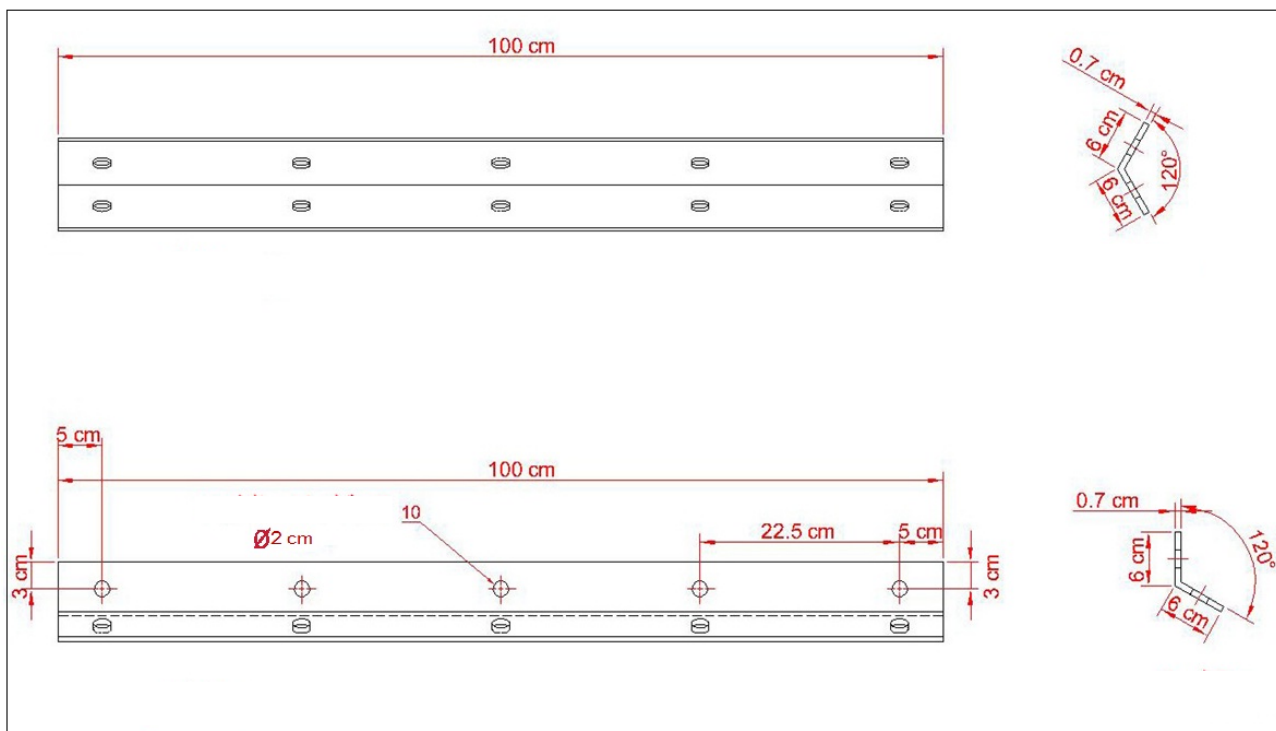

Fig. (4) The design model of the plate mounting angle ruler of share in ridge panel
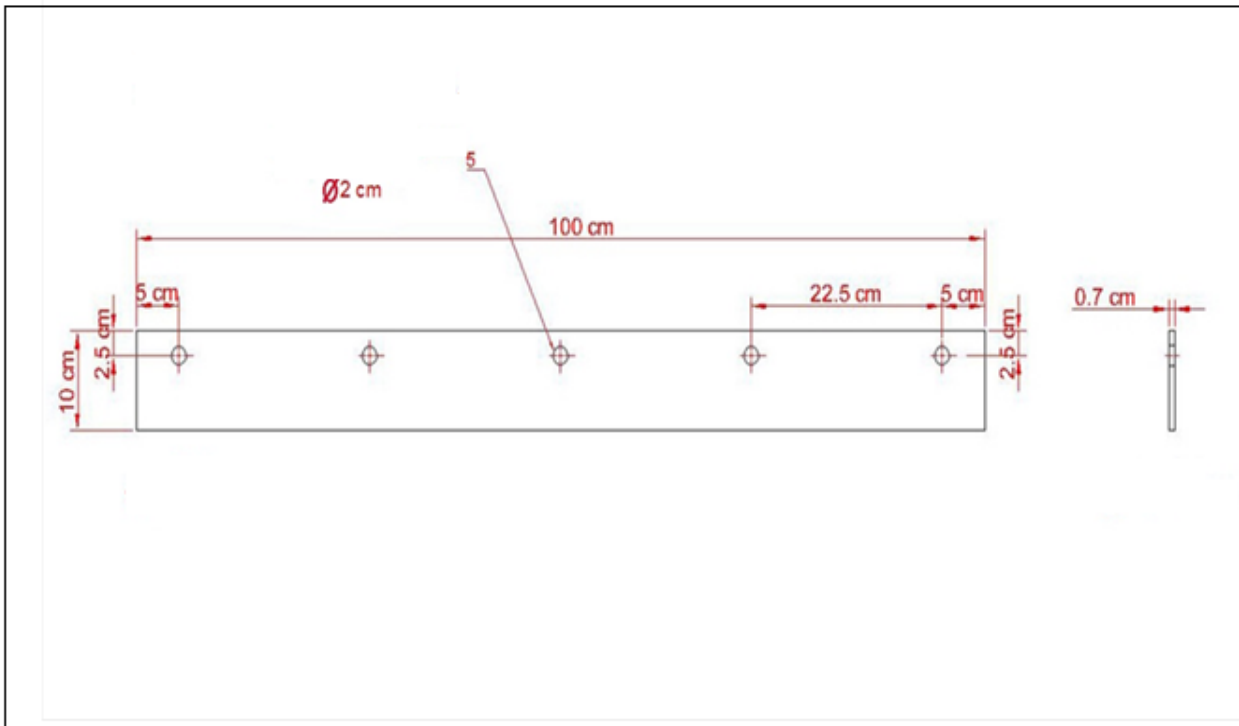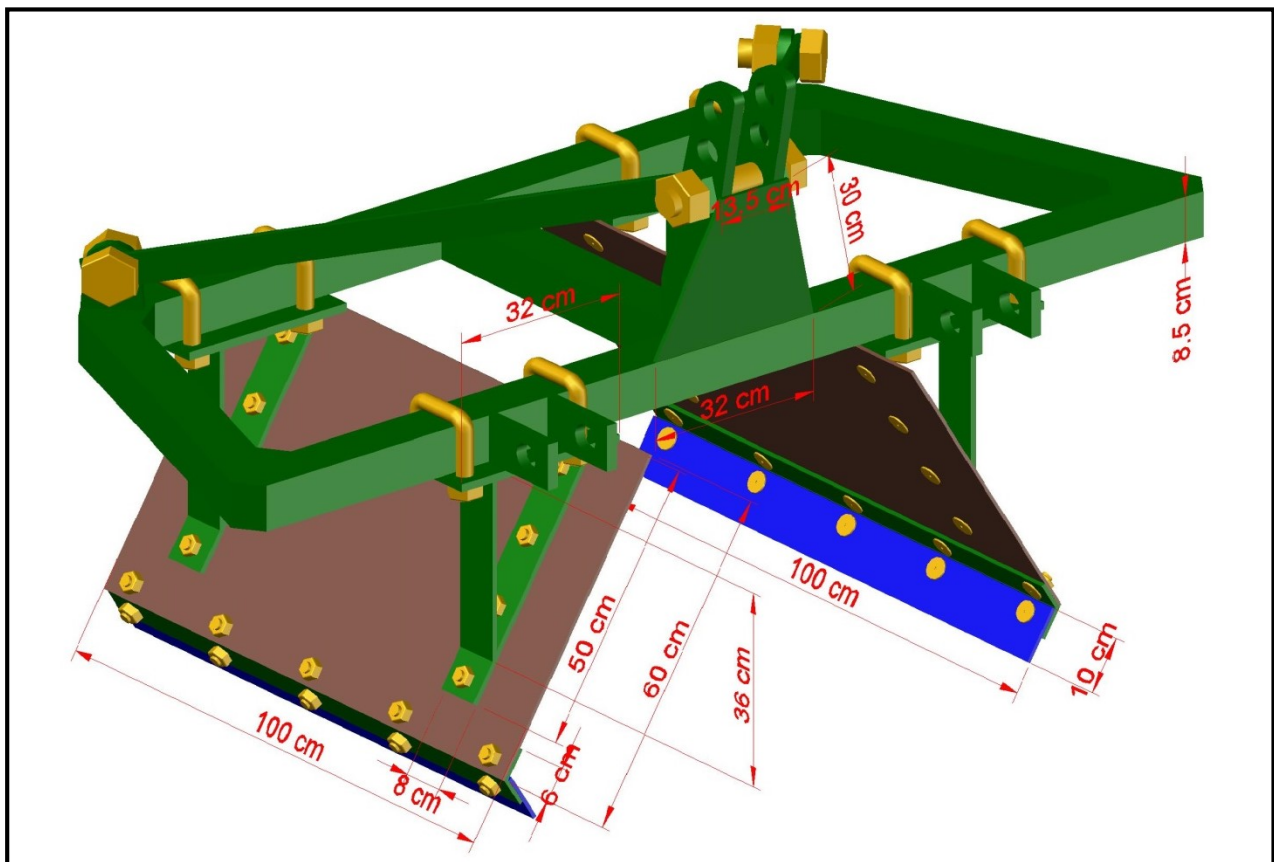
Fig. (5) Design model of share in ridge panel

Fig(6) ridge panel dimensions per part after assembly for manufactured parts
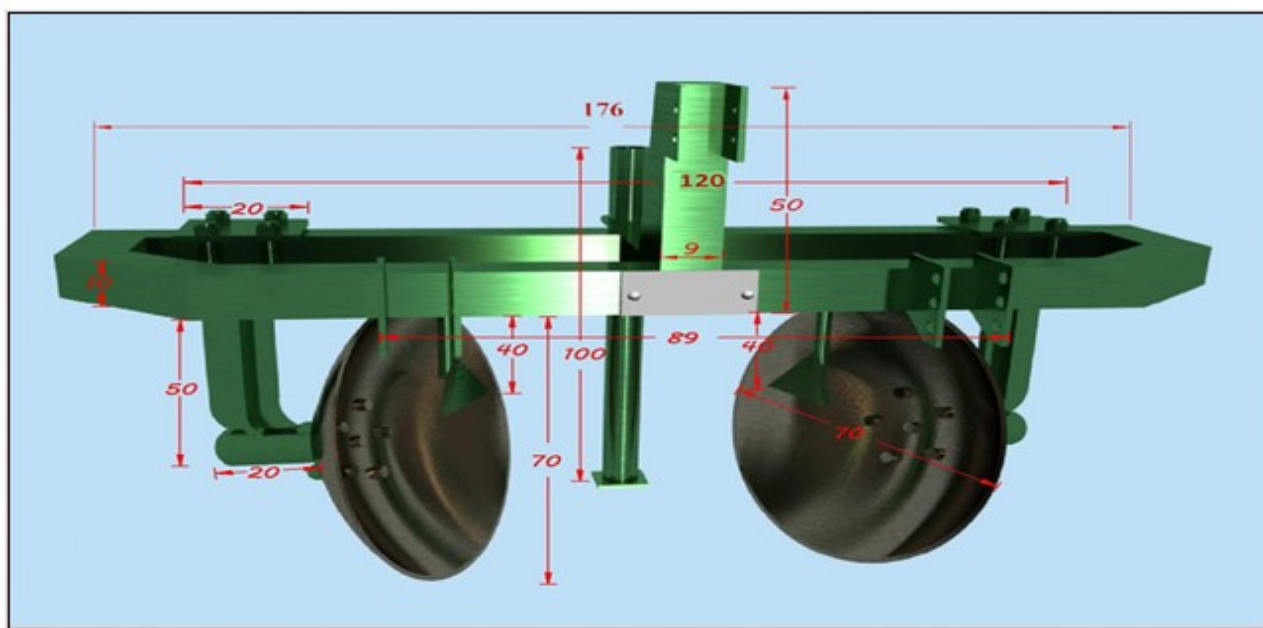
Fig.(7) ridge disc traditional dimensions per part

Draft force was measured which is known to represent the exploited capacity of the pulling of agricultural equipment, Work rate of time unit Represent the sum of multiply force in speed (Hussein and Ezzat,1978), It is also known as the measured power at the end of the pull arm or Hydraulic arm(Al Banna, 1990). is calculated from the following equation:

$$Pf = Ft * VP/3.6 \quad\ldots\ldots\ldots\ldots\ldots(1)$$

where :
pf= draft force (Mechanical horse) and then converted to kW
vp= Practical speed (km/hr)
Ft= pulling force (kn)

Slippage percentage is calculated from the following equation: Al- danasouri (2001)

$$Slippage\% = (Vt – Vp/Vt) *100 \quad\ldots\ldots\ldots(2)$$

Slippage%= slipping percentage
Vt= Theoretical speed without load (km/hr.)
Vp= Process speed with load (km/hr.)

Power-use-efficiency represent the number of cubic meters of raised soil by ridge Per Mega Joule (MJ) of energy consumed and effect in formation the ridge , This indicator is primarily based on design the ridge ,depth ridge and soil condition. Power-use-efficiency is calculated from the following equation:(Mckyes,1985).

$$\eta = (1/SR) \times 100 \quad\ldots\ldots\ldots\ldots\ldots(3)$$

η = Power-use-efficiency (m^3/MJ)
SR= Quality Resistance (KN/m^2)

The theoretical and actual productivity according to the following equations: Althan et al. (1991)

$$TFc = Sth * W/A \quad\ldots\ldots\ldots\ldots\ldots(4)$$

TFc= theoretical productivity(ha/hr.)

Sth= theoretical speed (m/hr.)
W= theoretical tool width (m)
A= unit area 10000(m^2)

$$EFc = Sa*W*E/AC \dots\dots\dots\dots(5)$$

EFc= actual productivity (ha/hr.)
Sa= Process speed (m/hr.)
W= actual tool width (m)
E= Efficiency%
AC= unit area 10000(m^2)

Efficiency of implement performance is calculated from the following equation:

$$EF(\%) = (EFc/TFc)*100 \dots\dots\dots\dots(6)$$

The size of the disturbed soil is calculated from the following equation: (Bernik and Vucajnk,2008)

$$S.D.V = Bp*Hp*Sp/2 \dots\dots\dots\dots(7)$$

S.D.V= the size of the disturbed soil(m^3/hr.)
Bp= actual ridge width (m)
Hp= ridge height (m)
Sp= Process speed (m/hr.)

RESULTS AND DISCUSSION

First: Effect of studied factors on draft force (kW): As shown in Table 2, forward speed (2.6) km/hr recorded lower drawbar power (6.34 kw) at 4 km/hr. This indicates that there was a positive relationship between speed and the power at drawbar by 51.31 %, which attributed to increases forward speed has led to an accelerated of soil components and get a aggregation of soil inside ridge this led to increase kinetic energy given to soil thus increasing draft force. Also local manufactured panel ridge recorded draft force5, 65kw, while disc ridge recorded 4.88kw. This was due to the design of the hard panels and their work inside the soil in a reptilian, increases soil friction with plates on the side and increases on the other side increases plates depth in soil the formation of a larger ridge. The interaction between the three factors was insignificant (P>0.05), where the disc ridge was resulted lower power at drawbar (3.51 kw) compared with local manufactured panel ridge at 2.6km/hr speed and 110 cm distance., also did not differ both ability with both ridge at same speed and distance (90)cm the results were(4.62,4.03)kw respectively also did not differ significant with ridge disc ability at speed (4)km/hr with distance (110) cm the result was(5.08)kw, while ridge disc recorded high drawbar power(6.89)kw with speed (4)km/hr and distance (110)cm which did not differ significant at the same time with draft force ridge panel at the same speed and both distance the results were (6.82),(6.58) kw respectively the reason back increases forward speed ridge increases distance between work parts whether panels or discs the larger the incubation of soil aggregates, the greater the need for the ridge to collect and accumulate the soil in the form of ridge needs to spend power and ability on high drawbar

Table (2) Effect of studied factors in draft force (kW)

forward speed km/hr.	distance between working parts (cm)	type ridge		interaction between the forwards speeds and distance	effect speed	effect distance
		panel	disc			
2.6	90	4.62bc	4.03bc	4.32		
	110	4.59bc	3.51c	4.05		
4	90	6.82a	5.08b	5.98		
	110	6.58a	6.89a	6.73		
interaction between the forward speeds and type ridge	2.6	4.60	3.66		4.19 b	
	4	6.70	5.98		6.34a	
interaction between distance and type ridge	90	5.72	4.55			5.13
	110	5.58	5.20			5.39
effect ridge		5.65a	4.88b			

(*) lower values for results are best

Second: Effect of the studied factors on the slippage percentage (%):

Data analyses presented in Table 3 shown that manufactured local panel ridge recorded higher slippage percentage (9.66)%, while disc ridge recorded (6.39)% due to the panels depth in soil of local ridge was higher compared with disc ridge. gathering soil at ridge panel large this due to increases load of rear wheels tractor this led increases slippage percentage while lower at ridge disc back to the circular motion of the discs which reduces the load on the rear wheels tractor this agree with (Spiess et al ,2005). Table 3 also indicated an effect significant clear interaction between forward speed ridge panel and distance working parts recorded speed (4) km/hr at distance (110) cm lower slippage percentage 6.66%, and higher slippage percentage recorded speed (2.6)km/hr at same distance which was (9.77)%,while distance (90) cm at both speeds recorded slippage percentage (7.62)% ,(4.04)% respectively. The reason for this the lower forward speed increases the distance between the working parts for both ridge increases the soil friction with the working parts and absorbs them to as much soil as possible during the formation of the ridge thus increasing the required stress at ridge this led increases slippage percentage counter to the high speed and the large distance between the working parts this due to lower slippage percentage is the deviation of the soil granules from each other while colliding with the working parts, whether panels or discs especially in rotary discs of ridge disc this reduce degree formation ridge this is reflected on the stress required to pull the ridge and then slip lower.

Table (3) Effect of studied factors on slippage percentage (%)

forward speed km/hr.	distance between working parts (cm)	type ridge		interaction between the forwards speeds and distance	effect speed	effect distance
		panel	disc			
2.6	90	8,96	6,28	7.62ab		
	110	11.86	7.69	9.77a		
4	90	9.84	6.25	8.04ab		
	110	7.99	5.33	6.66b		
interaction between the forward speeds and type ridge	2.6	10.41	6.99		8.70	
	4	8.91	5.98		7.35	
interaction between distance and type ridge	90	9.40	6.26			7.83
	110	9.92	6.51			8.22
effect ridge		9.66a	6.39b			

(*)lower values for results are best

Third: Effect of studied factors on power-use-efficiency (m³ / MJ):

Note from table (4) ridge panel recorded higher Power-use-efficiency(26.77) m³ / MJ while ridge disc recorded lower Power-use-efficiency (19.56) m³/MJ this due to the large area of the cross section ridge from ridge panel For the ability of the panels to deeper into the soil than the discs in ridge disc Thus reducing the value of soil quality resistance, which is a main component of Power-use-efficiency increases, This is agree with indicate Kepner et al (1982) and Ojha (1988). The results of the table also indicate an effect significant clear interaction between distance and type ridge ,Where ridge panel recorded higher Power-use-efficiency at distance (110)m the result was (28.41)m³/MJ while ridge disc recorded lower power-use-efficiency(17.88) m³/MJ at the same a distance this is due to increases Power-use-efficiency at ridge panel increases distance between the working plates and the portability on the lap of a larger amount of soils thus increasing the area of the soil section from depth and width ridge even height ridge this increases in area of the ridge section helped on increases ability to do better Power-use-efficiency this agree with EL-Sahrigi and Abohbaga (1993).

Table (4) Effect of studied factors on power-use-efficiency   (m³ / MJ)

forward speed km/hr.	distance between working parts (cm)	type ridge		interaction between the forwards speeds and distance	effect speed	effect distance
		panel	disc			
2.6	90	25.51	20.38	22.94		
	110	26.51	19.96	23.23		
4	90	24.76	22.09	23.42		
	110	30.31	15.81	23.06		
interaction between the forward speeds and type ridge	2.6	26.01	20.17		23.09	
	4	27.53	18.95		23.24	
interaction between distance and type ridge	90	25.13ab	21.24bc			23.18
	110	28.41a	17.88c			23.14
effect ridge		26.77a	19.56b			

(*)higher values for results are best

Fourth: Effect of the studied factors on field productivity (ha/hr):

Results showed in table (5) increases forward speed ridge from (2.6) to(4)km/hr led to increases field productivity from (0.16) to(0.26) ha/hr this due to speed component main productivity that increases field productivity this agree with Tsimba et al (2002).also the increase in the distance between the working parts increased from (90) cm to (110) cm increased field productivity from (0.16) to (0.23) ha/hr respectively this due to increase a distance led to increase actual work width ridge thus high ridge width Which is one of the main productive main, any increase in the actual operational width by increasing the distance will be followed by an increase in productivity this agree with Tsimba et al (2002). As for the type ridge, the ridge panel recorded higher field productivity (0.22) ha/hr compared with actual field productivity at ridge disc (0.20)ha/hr this due to width actual ridge at panels in ridge panel larger result high stability compared with width actual discs in ridge disc lower ,this effect significant on productivity because it is one of the factors on which productivity depends, this agree with Noborio et al. (1996).Interaction between the forward speeds and distance ,recorded the speed (4)km/hr at a distance (110)cm higher field productivity (0.28)ha/hr ,while the speed (2.6) km/hr at a distance (90)cm recorded lower field productivity (0.15)ha/hr. The results shown above show the relative proportion of actual field productivity with both the distance between the working parts and forward speeds, the greater the distance between the working parts and the forward speeds, the higher the field productivity as speed is one of the main factors involved in productivity. Which requires selecting the appropriate speed and determine at the appropriate distance that achieves the highest real field productivity, the distance between the working parts will affect the actual working width. When the distance between the working parts increases, the actual working width will increase, thus increasing the productivity. Interaction between forward speeds and type ridge the speed (4)km/hr at ridge panel recorded higher field productivity(0.27)ha/hr compared with ridge disc at speed (2.6) km/hr lower field productivity(0.16) ha/hr, ridge panel with distance (110)cm higher field productivity(0.24) ha/hr compared with ridge disc at distance (90)cm lower field productivity (0.19)ha/hr. The reason for the superiority ridge panel in this distance this is because the panels control the actual ridge width when increasing or decreasing the distance to incubate the soil within the measured distance between the working parts and the accumulation of soil without the deviation of soil in some of them through the local pressure of the ridge thus maintaining the totality of the soil from the rush to the inside, while discs in ridge disc the circular motion works to pull the soil and push it inward so that it does not give the actual working width when changing the distance between the working parts as well as the lack of access to the aspects of ridge, which causes the deviation of soil minutes from each other, which affects the supply of the actual work of the concrete and thus decrease the actual field productivity. Interaction between forward speeds and type ridge and distance recorded ridge panel higher actual field productivity (0.30)ha/hr at speed (4)km/hr and distance (110)cm ,while ridge disc recorded lower field productivity(0.14) ha/hr at the speed (2.6)km/hr and distance (90)cm. This due to increasing the distance between panels will increase the actual working width of the ridge which in turn will increase actual productivity, The increase in speed will increase the area of raised soil collected in the panels and thus increase the cohesion of soil aggregates, As a result of increasing the acceleration of soil together, thus maintaining the actual working ridge as speed and width are main factors in actual productivity, any increase in each will increase actual field productivity this is what happened in the ridge panel.

Table (5) Effect of studied factors on field productivity (ha / hr.)

forward speed km/hr.	distance between working parts (cm)	type ridge		interaction between the forwards speeds and distance	effect speed	effect distance
		panel	disc			
2.6	90	0.16g	0.14h	0.15d		
	110	0.18f	0.17f	0.18c		
4	90	0.24c	0.23d	0.23b		
	110	0.30a	0.27b	0.28a		
interaction between the forward speeds and type ridge	2.6	0.17c	0.16d		0.16b	
	4	0.27a	0.25b		0.26a	
interaction between distance and type ridge	90	0.20c	0.19d			0.16b
	110	0.24a	0.22b			0.23a
effect ridge		0.22a	0.20b			

(*)higher values for results are best

Fifth: Effect of the studied factors on the size of the disturbed soil (m³/hr):

Note from table (6) forward speeds increases ridge from (2.6) to (4) km/hr led to increasing size of the disturbed soil from (296.75)m³/hr to (516.89)m³/hr in the rate of increase of (74.18)% this due to area ridge section increasing forward speed ridge increases this led to increases the size of the disturbed soil because the relationship between them is direct this agree with (Carter and Sanderson ,2001).also increasing the distance from (90)cm to (110)cm led to increases the size of the disturbed soil , the rate of increase of (34.19)%, this due to area ridge section increasing the distance between the working parts this is reflected on the size of the disturbed soil Tesegaye et al (1993). It also notes that the highest value of size of the disturbed soil was(508.41)m³/hr, While lower valve recorded ridge disc (305.23)m³/hr this due to ridge panel recorded larger width and height these are considered ingredient of size of the disturbed soil and that the relationship between them is a direct increase in any width and height ridge increasing size of the disturbed soil this happened in ridge panel, this indicate Sharma et al (1993). Interaction between the forward speeds and distance show increasing size of the disturbed soil increases forward speeds ridge and increases the distance between the working parts and this is due to the relationship between them, higher size of the disturbed soil recorded speed(4)km/hr with distance (110)cm result was(588.58)m³/hr while higher size of the disturbed soil recorded speed(2.6)km/hr with distance (90)cm result was(249.64)m³/hr. The table is noted by the effect type ridge and forward speed significant in this index it surpasses ridge panel at speed (4)km/hr recorded higher size of the disturbed soil(636.31)m³/hr while ridge disc recorded at speed (2.6)km/hr lower value size of the disturbed soil(212.98)m³/hr. thus ridge panel recorded higher at distance (110)cm result was (603.25)m³/hr while ridge disc recorded at distance (90)cm lower value (281.27) m³/hr this due to the same reasons above effect forward speed and the distance between the working parts ridge on width and height ridge that area soil section which are proportionally proportional to both distance and speed as they increase the width and height this led to increases size of the disturbed soil special ridge panel (Al-Akukku,1996). Interaction between forward speeds and type ridge and distance recorded ridge panel higher value at speed (4)km/hr and distance (110)cm result was (760.22)m³/hr while lower value size of the disturbed soil recorded ridge disc at speed (2.6)km/hr and distance(110)cm result was (241.44) m³/hr. These results indicate the significant difference in the effects of interference on this indicator. It is noted that the size of the disturbed soil has increased by increasing the forward speed and all distances as ridge, especially ridge panel this led to the same seasons above paragraph.

Table (6) Effect of studied factors in the size of the disturbed soil (m³/hr.)

forward speed km/hr.	distance between working parts (cm)	type ridge		interaction between the forwards speeds and distance	effect speed	effect distance
		panel	disc			
2.6	90	314.75 f	184.53 h	249.64d		
	110	446.29 c	241.44 g	343.87c		
4	90	512.39 b	378.02 e	445.21b		
	110	760.22 a	416.93 d	588.58a		
interaction between the forward speeds and type ridge	2.6	380.52 c	212.98 d		296.75 b	
	4	636.31 a	397.47 b		516.89 a	
interaction between distance and type ridge	90	413.57b	281.27 d			347.42b
	110	603.25a	329.19 c			466.22a
effect ridge		508.41a	305.23 b			

(*)higher values for results are best

Sixth: Effect of studied factors on implement performance efficiency(%):

Note from Table (7) that increasing the distance between the working parts from (90) cm to (110) cm led to a decrease in the performance competence value from (68.30)% to(66.31)% respectively this due to increasing the distance between the working parts led to as much soil as possible which led to an increased ridge load and increased pull resistance this led to reduced performance competence, while ridge panel recorded higher value performance competence(70.26)% compared with ridge disc which recorded lower value performance competence(64.50)%, This is because actual productivity directly affects performance competence and that the relationship between them is positive as the increase in productivity in the ridge panel accompanied by an increase in performance efficiency and decrease in the ridge disc accompanied by a decrease in performance competence. Interaction between distance and type ridge show the ridge panel recorded at both distance(110 ,90)cm higher value performance competence results were(70.11)% and (69.96)% respectively, While ridge disc recorded lower value performance competence, especially at distance (110)cm result was (62.67)%. Interaction between forward speeds and type ridge and distance recorded ridge panel higher value performance competence(71.32)% at speed (4)km/hr and distance (110)cm which did not differ at the same time significantly from the value recorded by the same ridge at speed (2.6) km/h and distance (90) cm, which was (71.11)% while ridge disc recorded lower value performance competence at speed (2.6)km/hr and distance (110)cm which was (62.54)%, Which did not differ at the same time significantly with the performance competence recorded by the same ridge at speed (4) km / h and distance (110) cm, which was (62.80)%. These values indicate that performance competence is directly proportional to the increase in forward speeds, and are inversely proportional to the increased distance between the active parts of both ridge types, The reason for this is that increased speed leads to increased acceleration of soil compounds, Which increases the kinetic energy given to the soil and shortens the time needed to work ridge ,work many ridge short time this increases performance competence, While increasing the distance leads to a gathering of soil inside the ridge, The greater the distance between plates or disc large, the larger the soil aggregates would

be incubated, Thus, the need for ridge to collect and accumulate the soil in the form of a ridge requires high pull force, Thus a high draft force which causes low performance competence of the ridge.

Table (7) Effect of studied factors on performance efficiency (%)

forward speed km/hr.	distance between working parts (cm)	type ridge		interaction between the forwards speeds and distance	effect speed	effect distance
		panel	disc			
2.6	90	71.11a	66.21c	68.66		
	110	68.60b	62.54d	65.57		
4	90	69.41b	66.47c	67.94		
	110	71.32a	62.80d	67.06		
interaction between the forward speeds and type ridge	2.6	69.85	64.37		67.11	
	4	70.37	64.64		67.50	
interaction between distance and type ridge	90	70.26a	66.34b			68.30a
	110	69.96a	62.67c			66.31b
effect ridge		70.11a	64.50b			

(*) higher values for results are best

CONCLUSIONS: The main conclusions derived from this study are:
1- Draft force, field productivity and the size of the disturbed soil were increased by increasing the forward speed.
2- Actual field productivity and the size of disturbed soil increased by increasing the distance between the working parts, while the performance efficiency was increased at the lower the distance.
3- The draft force, field productivity, size of the disturbed soil, power-use-efficiency and performance efficiency have been increased under local manufactured panel ridge compared with disc ridge.

RECOMMENDATIONS AND FUTURE WORK:
Based on the outcome obtained from this study, a set of theoretical recommendations and future work were suggested:
1-The study undertaken recommends further investigations on different soil types and texture. In addition, long-term comparisons between need to be studied within different seasons to find out the agronomic and economic differences between these two ridges.
2- This study also recommended other researchers to do more investigations on the manufactured panel ridge within different soil conditions by placing several sensors in different locations in the plate of the ridge to understand the mechanical behavior of the panel.

REFERENCES:
AL- Banna, Aziz Ramo ,(1990) .Tillage Equipment. directorate of the House of Books for Printing and Publishing, University of Mosul, Ministry of Higher Education and Scientific Research.
Aday, S. H.; K. A. Hamid and R. F. Salman (2001). Energy requirement and energy utilization efficiency of two plow types for pulverization of heavy soil, Iraq J. Agric. 6(1): 137-146.
AL- Akukku, L., (1996). Persistence of soil compaction due to high axle loade traffic. 2. Long term effects on the properties of fine- textured and organic soils. Soil and tillage Research, 37: 223-238.

AL- Jalil, H. F., A. Khdair and W. Mukahal (2001). Design and performance of an adjustable three-point hitch dynamometer. Soil and Tillage Res. 62 (2001): 153-156.

Amin, E. (1990). Mechanization for potato production on small farms ph. D. theses, Agric. Eng. Dept fac. Coll. Agrc., Mansoura Univ.

AL- Dansouri, Massad Mohamed Mansour, (2001). Agricultural machinery, types and methods of evaluating their performance, Academic Library, Kingdom of Saudi Arabia - General Organization for Technical Training, p. 264.

AL- Zubaidi, Abdul Razzaq Abdul Latif Jassim, (2004). Effect of irrigation system and soil preparation equipment and softening in some properties of physical soil and growth of maize crop, PhD thesis, Department of Agricultural Mechanization, Faculty of Agriculture, University of Baghdad.

AL- Sheikha, Mohamed Ahmed ,(1988). Agricultural machinery (2) Power analysis, Department of agricultural mechanization, Faculty of Agriculture, Mansoura University, Egypt.

AL- Tahan, Yasin Hashim, Medhat Abdullah Hamida and Muhammad Kadri Abdul Wahab ,(1991). Economics and Management of Agricultural Machines and Machinery, Dar Al Kut Books for Printing and Publishing, Mosul University, Ministry of Higher Education and Scientific Research.

Bengough, A. G., Croser, C. and Pritchard, J. (1997). A biophysical analysis of root growth under Mechanical Stress. Plant and Soil, 189: 155-164.

Bernik, R., T. Godesa, P. Dolnicar and F. Vucajnk, (2009). Soil cover of tubers and the percentage of green tubers at various inter-row widths. Irish Journal of Agricultural and Food Research, 48: 35-41.

Bernik. R. and F. Vucajnk (2008). The effect of cultivator ridger type on the physical properties of ridge, power requirement and potato yield, Irish J. of Agricultural and Food Research, 47: 53-67.

Beukema, H.P. and Vander Zaay, D.E. (1990). "Introduction to Potato Production" Wageningen, Pudoc-III., Wageningen, The Netherlands, 208 pages.

Baabir, Ahmed Saleh, and Mohamed Fouad Wahbi (1994). Agricultural Tractors in Saudi Arabia, Gulf Arab Journal for Scientific Research, M12 (1): 171-185.

Canqui, HB. Lai R. (2009). Crop Residue Removal Impacts on soil productivity and Environmental Quality critical Reviews in Plant science, 28: 139-163.

Carter, M. R. and Sanderson, J. B. (2001). Influence of conservation tillage and rotation length on potato productivity, tuber disease and soil quality parameters on a fine sandy loam in eastern Canada. Soil and tillage Research, 63: 1-13.

Dahab, M.H. and M. H and M. D. Mutwalli (2002). Tractor Tractive Performance as affected by Soil Misture Content, Tires inflation Pressure and implement Type. AmA, 33: 29-34.

Dawood, Khalid Mohammed and Zaki Abdel-Elias (1990). Specialized Methods for Agricultural Research, Dar Al Kut Books for Printing and Publishing, Mosul University, Ministry of Higher Education and Scientific Research.

EL- Sahrigi, A. F. and M. M. Abohbaga (1993). Effect of seed bed of some siol fauna 5th int. con. On mechanization and energy in Agriculture 11-14 Oct. 1993, Kusadas, Tuekive.

Hussein, Lotfi and Abdel Salam Mahmoud Ezzat (1978). Field Crop Mechanization Equipment, Baghdad University Press, Ministry of Higher Education and Scientific Research

Hunt. Donnell (1995). Farm power and machinery management, 9th ed., lowa state univ press. U.S.A.

Kepner. R.A. Bainer, R, and E. L. Barger. (1982). Principles of from machinery, (3rd) Edition, The AVI pub. Co. Inc. West port, USA, l47-149.

Mckyes, E. (1985). Soil cutting and tillage. Development in Agricultural Engineering Quebec, Canada.

Noborio, K. K. J. Mcinnes, and J. L. Heilman. (1996). Two dimensional madel for water heat and soult transport in furrow irrigation siol. 11: field evaluation. Soil sci. soc. Amer. J. 60(4): 1010-1021.

Ojha, T.P. (1988). Success and failures of power tillers in Indian Agriculture. Agricultural Engineering Today, 12(2): 30-330.

Sharma, S. K. Dixit, R.S. and Tripathi, H. P. (1993). Water management in potato. Indian journal of Agronomy, 38: 68-73.

Spiess, E., Heusser, J., Ballmer, T., Gut, F., Scherer, C., Wuthrich, R. and Nebeisen, T. (2005). Reihenabstand (90cm) in kartoffelbau. FAT- Berichte, 635: 1-12.

Sud, V. K. (1986). Package of practices for Rabi crops in Himachal Pradesh. Directorate of Extension Education, Himached Pradesh krishivishvavidyalayll, palampur.

Tesegaye, T., J. F. Stone, and H. E. Reeves. (1993). Water use characterization of wide spaced farrow irrigation. Soil sci. soc. Amer. J. 57(1): 240-245.

Tsimba, J. Hussen and L.R. Ndlovu (2002). Relationships between Depth of Tillage and Soil Phsical Characteristics of Sites farmed by Smallerholders in Mutoko and Chinyika in Zimbabwe. Soil Science Society of America Journal, 66: 1669-1676.

Vucajnk, F., M. Vidrih and R. Bernik (2012). Physical and mechanical properties of soil for ridge formation, ridge geometry and yield in new planting and ridge formation methods of potato production. Irish Journal of Agricultural and food Research, 51: 13-31.

مقارنة البتان اللوحي المصنع محلياً بالبتان القرصي ودراسة تأثيره في بعض مؤشرات القدرة والأداء

عادل احمد عبدالله ، محمد صالح عبدالرحمن

قسم المكائن والآلات الزراعية ، كلية الزراعة والغابات ، جامعة الموصل

المستخلص

أجريت التجربة حقليا لدراسة تأثير نوعين من البتان (لوحي وقرصي) بمسافتين بين الأجزاء الشغالة (90 و110) سم وبسرعتين أماميتين (2,6 و4) كم/ساعة وفق مرحلتين هما: المرحلة الأولى تثبيت الأبعاد والقياسات الأساسية للبتان المراد تصنيعه مع تحديد نوع المعدن الملائم له وإجراء تحليل للتركيبة الكيميائية والخواص الميكانيكية لهذا المعدن ومن ثم القيام بعملية التصنيع، المرحلة الثانية: التقييم العملي لأداء البتان اللوحي المصنع محليا عن طريق قياس مؤشرات متطلبات القدرة التي تمثلت بالقدرة على ذراع السحب ونسبة الانزلاق وكفاءة استغلال الطاقة وبعض مؤشرات الأداء الحقلي المتمثلة بالإنتاجية الحقلية الفعلية وكفاءة الأداء وحجم التربة المثارة. وفق تصميم القطاعات العشوائية الكاملة بطريقة الألواح المنشقة – المنشقة، وتأثير ذلك في مؤشرات القدرة ومؤشرات الأداء، فقد أظهرت النتائج تفوق البتان اللوحي معنويا على البتان القرصي بتسجيل قيم أعلى لجميع مؤشرات القدرة والأداء كما تفوقت السرعة (4) كم/ساعة في إعطاء قيم أعلى لكل من قدرة السحب والإنتاجية الحقلية الفعلية وحجم التربة المثارة أما السرعة (2,6) كم/ساعة فقد سجلت قيم أقل لهذه المؤشرات، أما بالنسبة للمسافة (110) سم فقد تفوقت في إعطاء قيم أعلى لكل من الإنتاجية الحقلية الفعلية وحجم التربة المثارة في حين أعطت المسافة (90) سم قيم أعلى لكفاءة الأداء، أما عند التداخل بين السرعة الأمامية والمسافة بين الأجزاء الشغالة فقد تفوقت السرعة (2,6) كم/ساعة عند المسافة (110) سم بتسجيل أعلى نسبة انزلاق أما السرعة (4) كم/ساعة سجلت عند المسافة (110) سم أعلى إنتاجية حقلية وأعلى حجم تربة مثارة كما وجد ان جميع التداخلات بين السرع ونوع البتان والتداخلات بين المسافات ونوع البتان لها تأثير معنوي في مؤشرات القدرة والأداء حيث تفوق البتان اللوحي بتسجيل قيم أعلى لكل من كفاءة استغلال الطاقة والإنتاجية الحقلية الفعلية وكفاءة الأداء وحجم التربة المثارة، أما عند التداخل الثلاثي بين السرع والمسافات ونوع البتان فقد سجل البتان اللوحي قيم أعلى مقارنة مع البتان القرصي الذي سجل قيم أقل عند هذه التداخلات في جميع مؤشرات الأداء أما مؤشرات القدرة فقد سجل قيم لقدرة السحب.

الكلمات المفتاحية: البتان اللوحي، البتان القرصي، مؤشرات القدرة، الأداء .