

Tillage Appearance Device Test When Used Mold Board Plow Under Difference of a Variables Condition

^a Ahmed Abed Gatea Al-Shammary, ^b Ahmed Abd Ali Hamid Al-Mafrachi

^a Soil science and water resources department-College of Agriculture, University of Wasit, Iraq.

^b Department of the Interior Affairs Dormitories – University of Baghdad, Iraq.

Abstract: Tillage appearance device is mechanical, electric-electronic design, getting Patent from the Central Organization for Standardization and Quality Control – Industrial Property Department - Ministry of Planning – The Republic of IRAQ under number Patent 3876 in 20 / 4 / 2014, calculates the number of clods per area by Tillage appearance device, This is done through the generation electrical impulses are sent to the controlled accurate calculates number clods required space and shows the result on the screen in order to see the tillage view per area. Three factor used in these experiment, first factor represents forward speed of tractor three levels (3.5, 4.5, and 5.5 km/h), second factor represent soil moisture content at two levels (14 – 17 and 17- 20 %) and third factor was depth of tillage at three levels (10, 15 and 20 cm) in texture silt clay loam in Wasit city-Iraq. Split – split plot design under randomized complete block design with three replications and Least Significant Design 5 % was used to compare the between means of treatments. The result showed that significant differences to forward speed to the tractor on tillage appearance of more than 10 cm. Speed 5.5 km/h recorded lower number of clods 10 cm 6.5230 clods/m². Also result showed that the increase soil moisture content from 14-17 to 17-20 % led to increase the tillage appearance more than 10 cm from 7.5178 to 9.6200 clods/m² for tillage appearance device respectively, while the conventional method recorded 9.1639 to 9.9400 clods/m². Observed also depth of tillage 10 cm for the least number of clods soil more 10 cm were 6.753, 6.9633 clods/m² when used the tillage view device and conventional method respectively. There was a significant correlation between the reading of the tillage appearance device and conventional methods which means that the reading device was Accuracy.

Keyword: Tractor speed, Moldboard Plow, Clods of Soil, Tillage appearance device.

I. Introduction

Choosing machines agriculture is very important to show the extent of the validity of the work, results of the machines and successfully in the field work in terms of agricultural technical requirements in order to expand in the agricultural areas in the world, from the other hand choosing machine agricultural lead to finding solutions to the problems of these machines and show effect it of soil and crops. Tillage is the first agricultural operation for the purpose of creating shrine seeds through broken and fragmentation section soil which accomplished using the types of plows. Mold board plow is more using to tillage in Iraq compare with another plows because it became and enters early in this country. Measuring Appearance of Tillage is indication of the nature of the soil structure and building (Vazqeze 2002). Measuring Appearance of Tillage (number of clods > 10 cm) by determine the numbers clods soil which size more or bigger from 10 cm in one meter square from the soil tilled, which can't across from Sieve Wirier had distance between wire and another was 10 cm² (Jasim 2004). Alhashemi 2012 and Helal 2010 Founded significant effect in tractor speed on Appearance of Tillage, the slow speed tillage leaving more roughness Appearance of Tillage compare with high speed tillage which give least number of clods, the reason for this is increasing ejaculation the soil clods to the farthest distance which led to increasing broken or fragmentation coefficient. Roughness appearance of tillage is directly proportional with increasing depth of tillage (Al-Dnasori 2001). Altalbani 2010 and Alshjeari 2008 Founded increased number of clods with increasing depth of tillage form 15 cm to 20 cm. Raper et al 2000 mentioned the changes that happen in state, stricture and form soil a result from the speed of tillage operation, also he founded when used higher speed and reduced the depth of tillage was got a rough appearance and founded least number clods of soil in 6 km/hr, while in 3 km/hr and increasing the depth of tillage was got more roughness soil and more number of clods. Rajab 2005 Founded when increase the moisture content of the soil increased the number of clods soil, and the reason for this to increase the degree of conglomerate and adhesion soil grains each to other. The aim of these experiment was test Tillage appearance electronic device which getting Patent from the Central Organization for Standardization and Quality Control – Industrial Property Department - Ministry of Planning – The Republic of IRAQ under number Patent 3876 in 20 / 4 / 2014 and compare with conventional method to calculate the number clods of soil more than 10 cm (number of clods > 10 cm) under different tractor speeds, moisture content and soil depths of tillage.

II. Material and Methods

Field

Experiment conducted to test tillage appearance electronic device in one of agricultural fields in Taje Aldeen locality – Wasit Provencal – Iraq. Field area was 9850 m² and good topography. Five samples random took from field and analyzes in soil lap and the Soil texture was silt clay loam.

Experiment Design

Split-Split plot design under randomized complete block design with Three replication using least significant design (LSD) 5 % were used to compare between the mean of treatments (Al-Sahookie et al 1990). American Statistical analysis system (SAS) Program was used on analysis. Three factors were used in this experiment included Three speeds 3.5 , 4.5 and 5.5 km/hr which represented main plot, Two Moisture content soil were second factor included 14-17 and 17-20 % , and Three depths of tillage werw third factor included 10 , 15 and 20 cm. Experiment included 18 treatments with three replication for each treatment (3×2×3×3= 54 Treatments).

Mechanism Working of the tillage appearance device electronic

Tillage appearance device electronic got on panted from Central Organization for Standardization and Quality Control – Industrial Property Department - Ministry of Planning – The Republic of IRAQ under number Patent 3876 in 20 / 4 / 2014.

Working to measure tillage appearance by calculated the number clods of soil which specific size within specific area according to the type of plow. The Device works in two stages successive and three stages concurrent, Two stages successive as follows:

1- Specify the distance between measurement levers that is depend on the type and design of the plow and regulating the height of the mass measuring the plowing clods is done through spiral regulation (4) in the figure (3) were it regulate the height and low lever measuring clods of plowing (2), when rotating spiral regulation is raised and reduced the measurement levers clods of plowing by the spiral shaft (3) in figure (4) and pressed by the pressure spring (2) in fig (4) for its stability.

2- After organize of the device begins the process of tillage , when the plow finishes its work, the Device passes through the tillage area to start movement the measurement lever (see fig. 1)

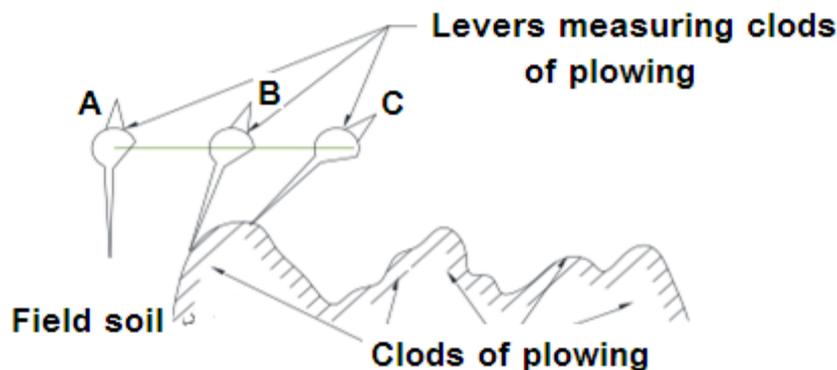


Fig. 1 Movement the measurement lever in the tillage area

When movement the levers measuring clods of plowing A to B then to C will press the sliding ring (4) in fig. 3 on the micro switch (1), the number of micro switches according to the tilt movement then an electrical signal will be connected through the electrical wiring (2) to the electronic circuit (3) in fig. 5, which prepare a regular pulse each pressed micro switch to bring it into accurate control (4) in fig. 5 for calculation the number of pulses from micro switch, which gives an impression of the number and size clods of plowing, in the same time, during movement the wheel chassis of device (2) in fig.2, the wheel shaft (7) will rotate then belt (4) rotate to rotary ring to calculate the distance which pressing on micro switch by rotary ring, the rotary ring pressing on micro switch one time for each wheel cycle, then the electronic circuit will generate pulses to accurate control for calculate the number of wheel cycle with save wheel circumference and plow width which equal the width of device (8) in fig.2 in accurate control, then can calculate the area of tillage and calculate the number of clods and finally we can evaluation the Appearance of Tillage.

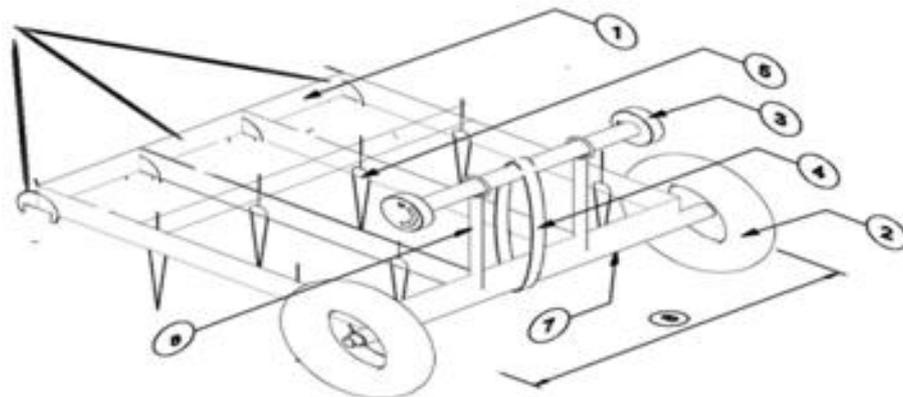


Fig.2. Parts of the measuring Device of the appearance of tillage. 1- Chassis 2- Wheels 3- Ring cycle 4- Belt 5-measuring clods of plowing 6- Suspender 7- Shaft 8- Device width equal plow width

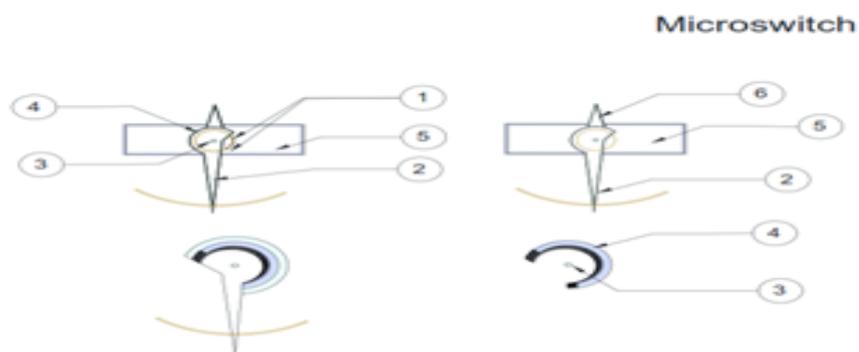


Fig.3 Micro switch and levers measuring clods of plowing. 1- Micro switch 2- levers measuring clods of plowing 3- Joints 4- Sliding ring 5- Base of the micro switch 6- Higher Regulator.

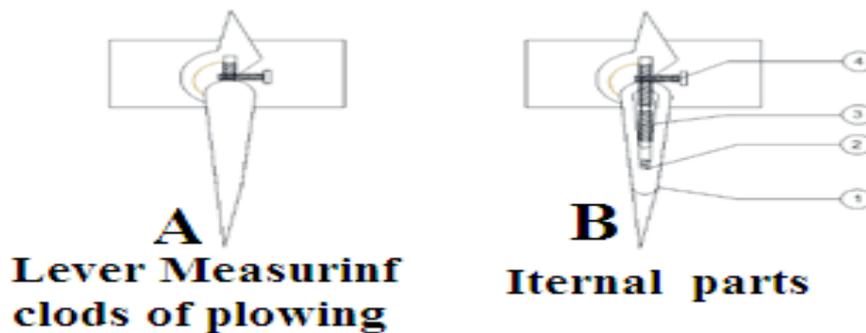


Fig.4. Regular of the higher lever measurement clods of plowing. 1- Chasses 2- Pressure spring 3- Shaft 4- Screw regulating.

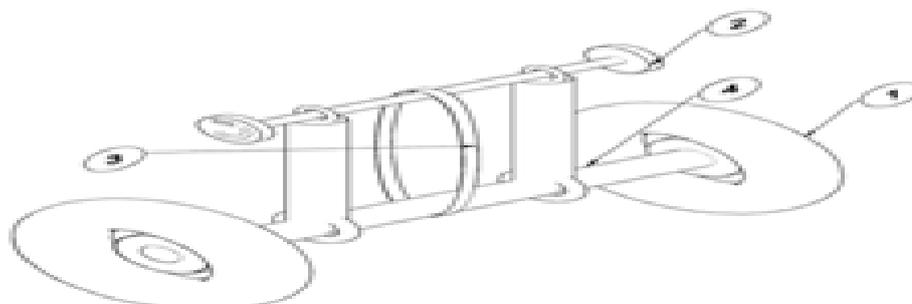


Fig 5. Distance measurement ring 1- Wheels 2- Rotating Ring 3- Belt 4- Shaft.

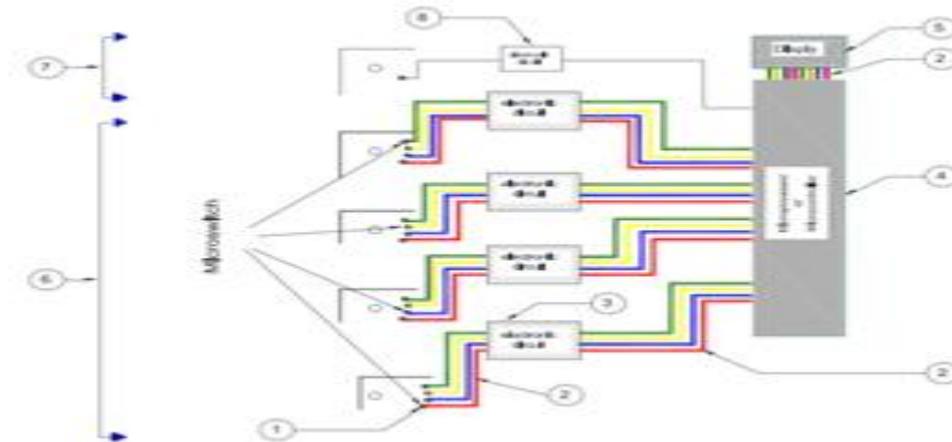


Fig 6. Electronic circuit for generation pulses to calculate the number clods of tillage (appearance tillage).
 1- Micro switch 2- wire 3- Electronic circuit 4- Accurate control to calculate the number clods of tillage 5- Display screen 6- pulses generation circuits 7- Distance measurement circuit 8- Electronic circuit to generate pulse distance measurement.

III. Experiment Method

Before the experiment, all devices used in the experiment were examined and controlled, where Turkish tractor was prepared with horsepower mechanical 85 hp , two-wheel driver, four stroke Diesel engine direct injection fuel and water cooling . Turkish mold board plow used, width 130 cm and weight 470 kg. plow was organized and joined behind the tractor. The speed of the tractor and the tillage were determined according to the design of the experiment, the number of engine cycle was fixed on 2000 rpm for all treatments by fuel hand levers and the gauge of number cycle engine. The field was split randomly according to the experiment design to main, secondary and sup-secondary plot. The field was irrigated then check and measurement soil moisture by took samples from the soil and put in oven to determined soil moisture, when the soil moisture reaches to the first soil moisture content 17-20 % we conducted the first part from experiment, after that we analyze soil moisture content until reached to second soil moisture 14-17 % and completed the experiment. After finished the operation tillage, Three random samples were selected in each treatment area 1 m², where it is measured dimensions clods of soil which founded enter this samples and recorded clods which diameter 10 cm in special paper. Then the appearance of tillage measuring by tillage appearance device was passed on the samples previously calculated which more than 10 cm and record the reading in another paper. Analyzes and compare the readings between the appearance of tillage measuring by tillage appearance device and the conventional method by used American Statistical Analyzes System (SAS) on least significant design 0.05.

IV. Result and Discussion

1- Effect of tractor speed and soil moisture and interaction in appearance of tillage (number of Clods > 10 cm).

Fig.7 showed that the speed of the tractor when increased from 3.5 to 4.5 then to 5.5 km/hr has led to a decreasing number clods of soil (number of Clods > 10 cm) on appearance tillage measuring device with decreasing ratio 0.3 and 3 % respectively, that because of increasing speed result to increasing velocity clods soil movement to far distance which destroyed and smashed the clods of soil and that agree with result (Raper et al 2000). Fig. 8 showed when increased soil moisture content from 14-17 to 17-20 % that led to increasing the number clods of soil (number of Clods > 10 cm) from 7.5178 to 9.6200 clods / m² for tillage appearance device, that because of increasing soil moisture led increasing the strength of cohesion between soil granules, so result to increasing clods of soil (number of Clods > 10 cm), and this result agree with result (Rajab 2005). Table 1. showed interaction between tractor speed with soil moisture, speed 5.5 km/hr with soil moisture 14-17 % recorded least number of clods soil (number of Clods > 10 cm) 5.503 and 5.690 clods /m² on tillage appearance device and conventional method respectively, while interaction between speed 3.5 km / hr with soil moisture 17-20 % higher clods of soil (number of Clods > 10 cm) 11.200 and 11.350 on appearance tillage measuring device and conventional method respectively.

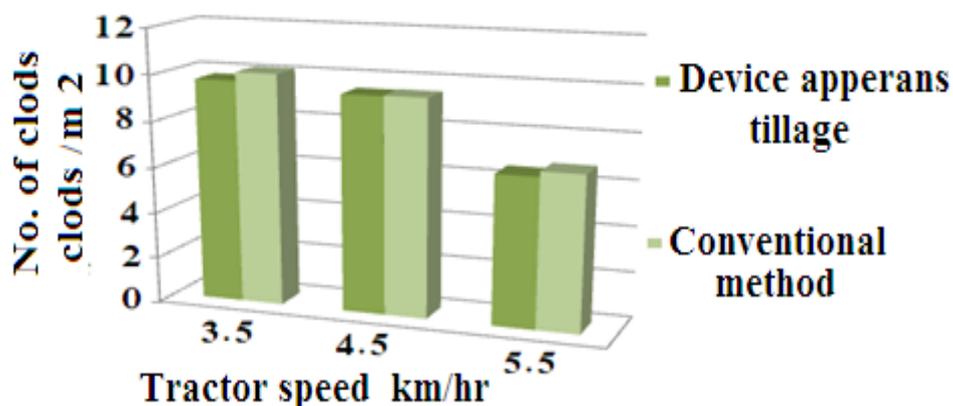


Fig.7 Effect of tractor speed on the number of clods soil (clods / m²).

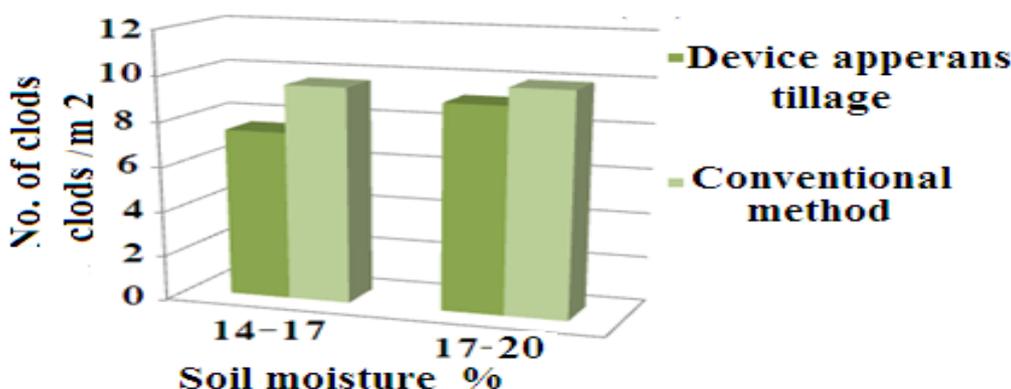


Fig.8 Effect of soil moisture on the number of clods soil (clods / m²).

Table 1. Effect of interaction between tractor speed and soil moisture for tillage appearance device and conventional method in the number of clods soil (clods / m²).

Tractor speed km / hr	Interaction between Tractor speed and soil moisture			
	Soil moisture %			
	14 - 17		17 - 20	
	Tillage appearance Device	Conventional method	Tillage appearance Device	Conventional method
3.5	8.283	12.90	11.200	11.350
4.5	8.767	8.900	10.200	10.633
5.5	5.503	5.690	7.543	7.837
LSD 0.05 Tillage appearance Device = 3.9678 Conventional method = 5.597				

2- Effect of tractor speed and depth of tillage and interaction in appearance of tillage (number of Clods > 10 cm).

Fig.9 showed increasing clods of soil more than 10 cm (number of Clods > 10 cm) from 6.72 to 11.00 clods /m² when increasing depth of tillage from 10 to 15 cm for used tillage appearance device, while conventional tillage recorded increasing from 9.255 to 10.920 clods / m² in the same depths, that because of the number of clods soil is directly proportional to the depth of tillage (Al-Bana et al 1986).

Table 2. showed interaction between tractor speed and depth of tillage, speed 5.5 km/hr with depth of tillage 10 cm recorded least number of clods soil (clods / m²) were 4.410 and 5.190 clods /m² on tillage appearance device and conventional method respectively, while interaction between speed 3.5 km / hr with depth of tillage 20 cm recorded higher clods of soil (number of Clods > 10 cm) 12.050 and 12.750 clods/m² on tillage appearance device and conventional method respectively.

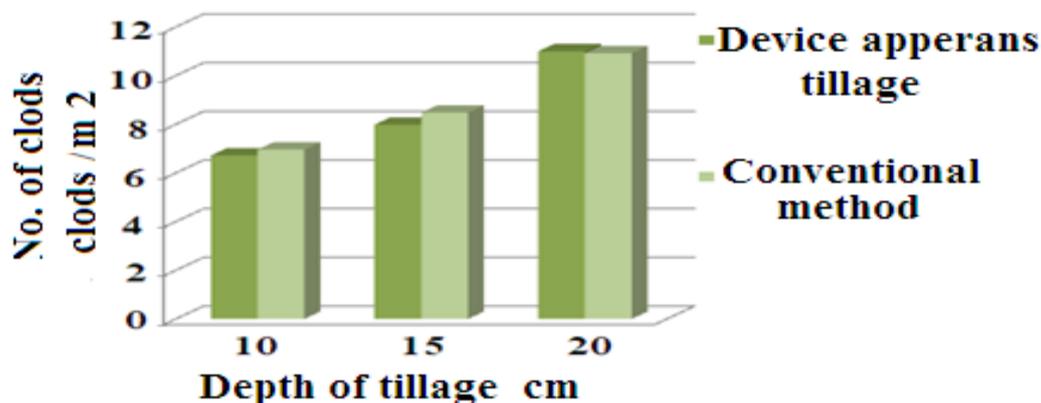


Fig. 9 Effect of depth of tillage on number of clods soil (clods / m²).

Table 2. Effect of interaction between tractor speed and depth of tillage for tillage appearance device and conventional method on the number of clods soil (clods / m²).

Tractor speed km / hr	Interaction between Tractor speed and depth of tillage					
	Depth of tillage cm					
	10		15		20	
	Tillage appearance Device	Conventional method	Tillage appearance Device	Conventional method	Tillage appearance Device	Conventional method
3.5	8.250	8.125	8.925	9.500	12.050	12.750
4.5	7.500	7.575	8.875	9.500	11.950	11.350
5.5	4.410	6.963	6.160	6.440	9.000	8.660
tillage Depth of mean	6.720	6.963	7.986	8.480	11.000	10.920
LSD 0.05	Tillage appearance Device = 3.597			Conventional method = 3.723		

3-Effect of soil moisture and depths of tillage and interaction in appearance of tillage (number of Clods > 10 cm).

Table 3 show interaction between soil moisture and depth of tillage, Soil moisture 14-17 % and depth of tillage 10 cm recorded least number clods of soil (clods / m²) were 5.737 and 5.807 clods /m² on tillage appearance device and conventional method respectively, while interaction between soil moisture and depth of tillage 20 cm recorded higher clods of soil (number of Clods > 10 cm) 12.00 and 12.033 clods/m² on tillage appearance device and conventional method respectively.

Table 3. Effect of interaction between soil moisture and depth of tillage for tillage appearance device and conventional method in the number of clods soil (clods / m²).

Soil moisture %	Interaction between soil moisture and depth of tillage					
	Depth of tillage cm					
	10		15		20	
	Tillage appearance Device	Conventional method	Tillage appearance Device	Conventional method	Tillage appearance Device	Conventional method
14 – 17	5.737	5.917	6.917	7.260	9.967	9.840
17 - 20	7.770	8.120	9.057	9.700	12.033	12.000
LSD 0.05	Tillage appearance Device = 3.329			Conventional method = 3.245		

4- Effect of interaction speed, soil moisture and depths of tillage in appearance of tillage(number of clods > 10 cm).

Table 4. showed tractor speed 5.5 km/hr, soil moisture 14 - 17 % and depth of tillage 10 cm recorded least number of clods soil more than 10 cm were 3.51 and 4.17 for tillage appearance device and conventional tillage respectively, while tractor speed 3.5 km/hr, soil moisture 17 – 20 % and depth of tillage 20 cm recorded 13.10 and 14.00 for tillage appearance device and conventional tillage respectively.

Table 4. Effect of overlap among tractor speed, soil moisture and depth of tillage for tillage appearance device and conventional method (clods / m²)

Tractor speed km/hr	Soil moisture %	Interaction tractor speed, soil moisture and depth of tillage						
		Depth of tillage cm						
		10		15		20		
		Tillage device	Conventional method	Tillage device	Conventional method	Tillage device	Conventional method	
3.5	14 – 17	6.50	7.00	7.35	8.20	11.00	11.50	
	17 – 20	10.00	9.25	10.50	10.80	13.10	14.00	
4.5	14 – 17	7.00	6.25	8.40	8.50	10.90	10.20	
	17 – 20	8.00	8.90	9.35	10	13.00	12.50	
5.5	14 – 17	3.51	4.17	5.00	50	8.00	7.80	
	17 – 20	5.31	6.21	7.32	7.80	10.00	9.50	
LSD 0.05	Tillage appearance device = 1.85		Conventional method = 1.80					

Table 5. showed the Regression (R²) were 0.9684 and 0.9835 for tillage appearance device and conventional method respectively , Also coefficient of variance (C.V) were 6.512 and 4.453 for tillage appearance device and conventional method respectively, and from analyzes Correlation (R) noticed significant Correlation 0.9680 between Tillage appearance device and Conventional method which giving a proof of accuracy of tillage appearance device readings.

Table 5. ANOVA table for Tillage appearance device and Conventional method for calculated the number clods of soil more than 10 cm (number of Clods > 10 cm).

Inst	source	df	SS	MS	F table	F pr	R ²	C.V	Root MSE	mean
Tillage appearance device	Model	5	115	23	73.68	0.0001	0.9684	6.512	0.5187	8.58
Conventional method	Model	5	109.86	21.97	143.46	0.0001	0.9835	4.453	0.3913	8.78

V. Conclusion

1. Increasing tractor speed from 3.5 to 4.5 then to 5.5 km/hr led to reduced in number of clods soil more than 10 cm (number of Clods > 10 cm) with decreasing ratio 0.3 and 3% for tillage appearance device, 0.64 and 3.92 % for conventional method.
2. Increasing moisture of soil led to increasing clods of soil more than 10 cm from 7.5178 to 9.6200 clods/ m² for tillage appearance device and 9.1630 to 9.9400 clods /m².
3. Depth of tillage recorded least number of clods soil more than 10 cm, while depth of tillage 20 cm recorded higher of clods soil more than 10 cm .
4. Interaction among treatments were significant on appearance of tillage when used Tillage appearance device and Conventional method.
5. Founded Significant correlation 0.9780 between Tillage appearance device and Conventional method, and that a proof on accuracy Tillage appearance device readings.

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