

## EFFECT OF THE TRACTOR SPEEDS and TYPE CONVEYOR ON THE QUALITATIVE LOSS and DAMAGE POTATO TUBERS

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### ABSTRACT

A field experiment was conducted in one of the fields of the Technical Institute in Shattha for the season 2022 to study the effect of different tractor speeds, type conveyor chain on the qualitative loss and damage potato tubers. severely scratched tubers and slightly scratched tubers, and qualitative loss were studied in this research. The first factor was forward speeds (2.5, 3.20 ,4.0 km.hr-1), and two levels of conveyor chain speeds (38, 49) m. min-1 and third factor two level of type of chain conveyor of rubber bars and clothes -coated. The complete random design with three replications was used in the research. The results showed that the tractor speed 2.5 km/h in gets the severely scratched tubers, which amounted to 2.53 %, and the slightly scratched amounted to 11.15 %, and the lowest qualitative loss was 10.85%.

**Keyword:** qualitative loss, severely scratched, slightly scratched.

### INTRODUCTION:-

The introduction of integrated mechanization in the operations of planting the potato crop and its harvesting will help reduce labor, production costs and reduce damage to the crop to the minimum possible, and shorten the time , effort to perform all operations, increase production and speed up all operations, which is required when implementing any agricultural operation Al-Banna) 1998(. Potato tuber extraction operations are carried out with several types of harvesting machines, one of which is the potato digger with chain conveyor. Because it is grown and grows under the surface of the soil at different depths, the machine's handling and direct contact between the mechanical components of the harvesting machine and the tubers will affect the quality of the product in different proportions. Ghalib (2019) Baritelle et al ., (2000) . In a study on the development of a mechanical separation system for potato tubers in a locally designed and manufactured potato plant, the reason for the slightly higher percentage of scratched tubers in the tubers is the effect of the roughness of the tubers separation system, which is intended for the vibrating chain conveyor, as well as the force of strikes on tubers by the vibrators during their transfer on the conveyor . Siddiq & Saad (2012 )and (Daoud et al., 2003) . One of the most important benefits of mechanical harvesting of the potato crop is that it saves 65% of the harvest time compared to By manual harvesting and more than 45% of the harvest costs(Muhammad et al., 2003). explained Da Cunha et al., (2007) and ( Ibrahim et al ., 2007) that there are a set of basic factors that determine the amount of bruises that occur in potato tubers, , including the condition of the soil, is wet or dry soil, and the type of soil, as well as the condition of the tubers, they are fully ripe or not. This

includes the soil temperature, the type of harvesting process mechanical or manual, the type of machine used, the accuracy of its calibration, as well as the time of the harvesting process. According (Ismail et al ., 2014 ) In an experiment using three forward speeds, they are 3.6, 5.1 and 7.2 km. Hr 1- and its effect on the percentage of damage and total damage to the tubers, as the speed increased from 3.6 to 7.2 km. Hr-1 led to an increase in the percentage of damage from 2.80 to 3.85%, while the percentage of undamaged tubers decreased from 97.12 to 96.15%. indicated that the increase in speed leads to a decrease in soil adhesion to the surface of the tubers, which helped in easing the separation of the soil when the crop was uprooted . According to Al-Hashemi 2012 The tractor speed 7.27 superiority the speed 4.27 and 5.51 km / h in the best indicators of field performance and capacity requirements. While( Jassem et al., 2006) .used rubber-coated chain conveyors as one of the important ways to reduce the damage that occurs in tubers and as one of the preventive methods to reduce the loss and major and slight damage to tubers. Peter (2016) believed that the ratio between the forward speed of the machine and the speed of the chain conveyor is more important than the forward speed only, and that tuber damage can increase with the increase in the forward speed of the machine.. Because of the importance of studying the potato digger with the chain conveyor , and the lack of studies and researchers in this regard, this study came with the aim of designing and developing a machine for extracting, collecting and isolating the coarse potatoes from the soft ones in the least possible time, without any manpower, and with integrated mechanization identification and reduction of damage to the tubers in each part at the digger.

#### **MATERIALS AND METHODS :-**

The experiment was conducted on the fields of the Technical Institute in Shatrah, Iraq in season in sandy soil 2022. The results were statistically analyzed and significant differences were tested using the least significant difference (LSD) method at the probability level (0.05) General treatment structure under randomized block design(RCPD). With Three replication were used in this experiment .The main plot included the tractor's speed in three levels: 2.5, 3.20 and 4.0 km / hr The second factor the speed of the chain conveyor has two levels: 38 and 49 m/min and a type of the chain conveyor two levels are rubber rods and clothes -coated rods as a sub-secondary treatment using the MF tractor type.

#### **MACHINE PARTS :-**

This fortress is made up of a triangular rail on the M, with a width of 64 cm, and two pieces that are inclined inward at an angle of 25 degrees. They are located in the front, and because the weapon rail is located in the front of the digger , this helps to push the tuber with to the top, where it falls on a closed chain conveyor with iron plates 94 and 46-cm-wide slab which extends across the width of the pod with 2.5-cm spacing between the bars allowing the plucked potato tubers to move to the rear while lumps, impurities and plant debris fall through the spaces between the rear-swivel chain-carrier panels where they are mounted on a number of star wheels and two pairs of oval wheels, each two wheels on one side of the structure to give vibrating movement and to get rid of

the dirt blocks stuck to the tubers, and the presence of cylindrical wheels at the back of the digger works to support the machine's structure as well as its basic role in giving an inclination to the take-off angle (25) degrees that takes its movement from the rear drive shaft of the puller PTO through a group of gears pivoting a bevel gear and a crown gear that connects at the end of the drive shaft the power take-off shaft of the puller and in its end from the top connects the gear to the movement and is connected at the top of the digger from the front by means of the three points. When the potato tubers reach the back of the chain conveyor, the tubers fall directly due to the ground force on a side conveyor that takes its movement from the back of the rear drive shaft with the pulley through pulleys and the belt to be conveyed. The large-sized potato tubers are transferred to the side packing and bagging unit, and when the weight inside the bag reaches a weight of 30 kg, the bag will fall by itself. A closed conveyor belt has been manufactured that rotates backwards with the same rotation as the chain conveyor of the digger in order to transport the small and soft potato tubers with a radius of less than 7 cm. Second bagging unit is connected at the back of the digger, and then the process of extracting the tubers has been completed mechanically and completely without the need for the use of labor to collect the potatoes from the ground.



Figure (1) components of potato digger with side and rear conveyor.



figure(3)side and the rear Conveyor



Figure (2) rubber coated  
Conveyor

**RESULTS and DISCUSSION :-**

**Severely scratched tubers -: %**

Table (1) shows the effect of the tractor’s speed, the speed of the chain conveyor, the type of chain conveyor, and the interactions between them in the severely scratched tubers. Increasing the tractor speeds from 2.5 to 3.20 and then to 4.00 km .hr-1 caused an increase in severely scratched tubers from 2.53 to 4.49 and then to 6.40 % This is because when the speed is increased, it reduces the depth of the extraction digger , and the tubers are extracted at a depth less than required, and thus an increase in cutting and scratching the tubers significantly, as the relationship between the forward speed and the percentage of scratched tubers is significantly and this is consistent with the results reached Al-Obaidi (2012).

Table (1) shows the effect of the speed of the chain conveyor on severely scratched tubers, as it is noted that the speed exceeded 38 m/min in achieving the lowest percentage of scratched tubers, which amounted to 3.82 %, while the highest of the percentage of severely scratched tubers was in the speed of the chain conveyor 49 m/ min amounted 5.13 %. The table shows the effect of the type of chain conveyor on the percentage of severely scratched tubers, where the clothes -coated type of rods outperformed in achieving the lowest value, amounting to 4.30 %, while the highest percentage was in rubber rods, amounting to 4.65%.

**Table (1)Effect of tractor speed, chain conveyor speed, chain conveyor type and the interactions between them in severely scratched tubers**

Indicators	Severely scratched tubers ( %)				Interaction between practical speed and chain conveyor speed
	Chain conveyor Speed m\ min	Interaction between practical speed and chain conveyor speed and type conveyor		Chain conveyor speed	
		Rubber conveyor	Clothes conv		
Practical speed km / hr	38	1.95	1.82	1.88	
	2.5 49	3.72	2.64	3.18	
	3.20	38	3.89	3.78	3.83
		49	5.22	5.10	5.16
	4.00	38	5.89	5.59	5.74
		49	7.25	6.90	7.07
Lsd = 0.05			0.077		
Type conveyor	4.65		4.30		
Lsd =0.05			0.044		
Chain conveyor Speed	Interaction between chain conveyor speed and type conveyor			Chain conveyor speed medial	

m\ min				
38	3.91		3.73	3.82
49	5.39		4.88	5.13
Lsd = 0.05			0.044	
Practical speed		Interaction between practical speed and		Practical speed
Km/ hr		Type conveyor		medial
2.5	2.83		2.23	2.53
3.20	4.55		4.44	4.49
4.00	6.57		6.24	6.40
Lsd = 0.05			0.025	

**The slightly scratched tubers :- ( % )**

Table (2) shows the effect of the tractor’s speed, the speed of the chain conveyor, the type of chain conveyor, and the interactions between them in the slightly scratched tubers. Increasing the tractor speeds from 2.5 to 3.20 and then to 4.00 km .hr-1 caused a light increase from 11.85 to 13.75 and then to 16.30 % The reason for this may be due to an increase in the speed of the system for separating or getting rid of the dirt blocks stuck to the tubers by increasing the speed, thus increasing the roughness of the effect of the machine’s handling with the soil mixture and tubers and the force of the blows directed at the tubers by the vibrators of the chain conveyor and this is consistent with the results reached Siddiq and Saad (2012). Table (2) shows the effect of the speed of the chain conveyor on slightly scratched tubers, as it is noted that the speed exceeded 38 m/min in achieving the lowest percentage of scratched tubers, which amounted to 13.21%, while the highest percentage of the percentage of slightly scratched tubers was in the speed of the chain conveyor 49 m/ min amounted 14.73 %. The table shows the effect of the type of chain conveyor on the percentage of slightly scratched tubers, where the clothes -coated type of rods outperformed in achieving the lowest value, amounting to 13.88 %, while the highest percentage was in rubber rods, amounting to 14.05%. this is consistent with the results reached Siddiq (2006) .

**Table (2) Effect of tractor speed, chain conveyor speed, chain conveyor type and the interactions between them in slightly scratched tubers.**

Indicators	Severely scratched tubers ( % )			Interaction between practical speed and chain conveyor speed
	Chain conveyor Speed m\ min	Interaction between practical speed and chain conveyor speed and type conveyor	Rubber conveyor	
Practical speed km / hr	38	1.95	1.82	1.88
	2.5	49	3.72	3.18
	3.20	38	3.89	3.78

	49	5.22	5.10	5.16
4.00	38	5.89	5.59	5.74
	49	7.25	6.90	7.07
Lsd = 0.05			0.077	
Type conveyor	4.65		4.30	
Lsd =0.05			0.044	
Chain conveyor	Interaction between chain conveyor speed and type conveyor		Chain conveyor speed medial	
Speed m\ min				
38	3.91		3.73	3.82
49	5.39		4.88	5.13
Lsd = 0.05			0.044	
Practical speed Km/ hr	Interaction between practical speed and Type conveyor		Practical speed medial	
2.5	2.83		2.23	2.53
3.20	4.55		4.44	4.49
4.00	6.57		6.24	6.40
Lsd = 0.05			0.025	

### Qualitative loss :- (%)

Table (3) shows the effect of the tractor's speed, the speed of the chain conveyor, the type of chain conveyor, and the interactions between them in the qualitative loss tubers. increasing the tractor speeds from 2.5 to 3.20 and then to 4.00 km .hr-1 causing an Increased qualitative loss from 10.85 to 12.55 and then to 14.80 %respectively. The reason for this may be due to an increase in the speed of the system for separating or getting rid of the dirt blocks stuck to the tubers by increasing the speed, thus increasing the roughness of the effect of the machine's handling with the soil mixture and tubers and the force of the blows directed at the tubers by the vibrators of the chain conveyor and this is consistent with the results reached Siddiq and Natiq (2012) .

Table (3) shows the effect of the speed of the chain conveyor on qualitative loss , as it is noted that the speed exceeded 38 m/min in achieving the heights percentage of qualitative loss, which amounted 13.38 %,while the lowest of the percentage of qualitative loss was in the speed of loss , where the clothes -coated type of rods outperformed in achieving the lowest value, amounting to 12.66 %, while the highest percentage was in rubber rods, amounting to 12.87% .



**Table (3)Effect of tractor speed, chain conveyor speed, chain conveyor type and the interactions between them in Qualitative loss .**

Indicators	Severely scratched tubers ( %)			Interaction between practical speed and chain conveyor speed
Practical speed km / hr	Chain conveyor Speed m\ min	Interaction between practical speed and chain conveyor and type conveyor		Interaction between practical speed and chain conveyor speed
		Rubber conveyor	Clothes conv	
	38	1.95	1.82	1.88
2.5	49	3.72	2.64	3.18
3.20	38	3.89	3.78	3.83
	49	5.22	5.10	5.16
4.00	38	5.89	5.59	5.74
	49	7.25	6.90	7.07
Lsd = 0.05			0.077	
Type conveyor	4.65		4.30	
Lsd =0.05			0.044	
Chain conveyor Speed m\ min	Interaction between chain conveyor speed and type conveyor			Chain conveyor speed medial
38	3.91		3.73	3.82
49	5.39		4.88	5.13
Lsd = 0.05			0.044	
Practical speed Km/ hr	Interaction between practical speed and Type conveyor			Practical speed medial
2.5	2.83		2.23	2.53
3.20	4.55		4.44	4.49
4.00	6.57		6.24	6.40
Lsd = 0.05			0.025	

**Conclusions and Recommendations:-**

From the above results, it is clear that the lowest percentage of severe scratching has been achieved in 2.5 km/h which amounted to 2.53%, and the slightly scratched amounted to 11.85%, and the lowest qualitative loss was 10.85%, while the speed of the chain conveyor 38 m/min gets the lowest percentage of severely scratched tubers , which amounted to 3.82% The slightly scratched was 13.21%, while the speed of the chain conveyor was 49 m/min The lowest qualitative loss was 12.07%, and the clothes rods had the lowest percentage of severely scratched tubers, slight

scratched and qualitative loss. Therefore, we recommend using a potato digger with tractor speed 2.5 km/h, chain conveyor speed 38 m/min and clothes coated bars of chain conveyor.

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