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المجلة العراقية لبحوث السوق وحماية المستهلك

POSSIBILITY OF REDUCING THE QUANTITATIVE END QUALIITATIVE LOSSES BY USING THE POTATO DIGGER

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ABSTRACT

A field experiment was conducted in one of the fields of the Technical Institute in Shatrha for the spring season 2022 to study the effect forward speeds (2.50, 3.18 ,3.60 km. hr-1), and two levels of conveyor speeds (43, 49) m. min-1 and two level of type of chain conveyor of rubber bars and clothes -coated in possibility of reducing the quantitative and qualitative losses by using the potato digger. quantitative loss, qualitative losses, and field efficiency were studied in this research. The randomized complete block design with three replications was used in the research. The results showed that the tractor speed 2.50 km.hr-1 in gets the quantitative losses which amounted to1.40 %, and the qualitative losses amounted to 11.1%, and the tractor speed 3.60 km. hr-1 gets the heights Field efficiency amounted to 84.80%.

Keywords: field efficiency, tractor speed, speed conveyor.

امكانية تقليل الفقد الكمي والنوعي باستخدام قالعة البطاطا

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الخلاصة

اجريت تجربة حقلية في احد الحقول التابعة الى المعهد التقني في الشطرة للموسوم2022 الربيعي لدراسة تأثير سرعة الجرار وبثلاث مستويات هي 2.50 و 3.18 و 3.60 كم/ ساعة والعامل الثاني سرعة الناقل السلسلي وبمستويين هما 43 و49 م/ دقيقة والعامل الثالث نوع الناقل وبمستويين هما قضبان مغلفة بالمطاط وقضبان مغلفة بالقماش في امكانية تقليل الفقد الكمي والنوعي لدرنات البطاطا باستعمال قالعة البطاطا.

الصفات المدروسة هي الفقد الكمي والفقد النوعي والكفاءة الحقلية تم استخدام تصميم القطاعات العشوائية الكاملة وبواقع ثلاث مكررات. اظهرت النتائج تفوق سرعة الجرار 2.5 كم/ ساعة في الحصول على اقل فقد كمي 40. 1%واقل فقد نوعي 11.1 % وحققت سرعة الجرار 3.60 كم/ ساعة اعلى كفاءة حقلية وبلغت 84.80%.

الكلمات المفتاحية: الكفاءة الحقلية، سرعة الجرار، سرعة الناقل.

[*] **The research is extracted from the doctoral thesis of the first researcher.**

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 in all operations, increase production and speed up all operations, which is required when implementing any agricultural operation **(Al-Banna, 1998).**

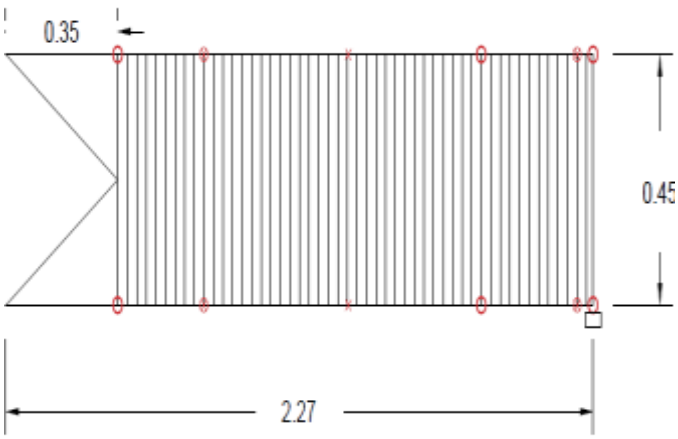
Potato tuber extraction operations are carried out with several types of harvesting machines, one of which is the potato digger with chain conveyor. Because it is grown under the surface of the soil at different depths, the machine's handling and direct contact between the mechanical components of the 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**; **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**; **Ibrahim *et al*., 2020)** Showed 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.

(Ismail *et al*., 2014) Mentioned that 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 **(Jassim *et al*., 2006**; **Jassem & Al-Rawshdie, 2014)** Showed that 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 slight damage to tubers**.(Al-ani *et al*., 2004**; **Ibrahim *et al*., 20007)** Pointed out 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 on sandy soil for the spring season of 2022. The results were statistically analyzed and significant differences were tested using the least significant difference method at the probability level (0.05) General treatment structure under randomized black design. With Three replication were used in this experiment .The main plot included the tractor's speed in three levels: 2.5, 3.18and 3.60 km . hr^{-1} The second factor the speed of the chain conveyor has two levels: 43 and 49 m.min-1 and a type of the chain conveyor two levels are rubber rods and clothes -coated rods as a sub-secondary treatment using the MF 285S tractor type.

Figure (1): components of potato digger.



figure(2): ram diagside and the rear Conveyor.

Figure (3): clothes coated bars

Studied indicator:

Quantitative Loss %

Tubers that were not extraction or that were buried after the extraction process

Qualitative loss %

Total damage tubers of severely and slightly

Field efficiency %

Measured using the proposed equation from (Buckingham et al. ,1976)

$$Fe = \left(\frac{Pp}{Pt}\right) \times 100$$

Fe:- Field efficiency :- %

P_p: Practical productivity ($ha.hr^{-1}$)

P_t: Theoretical productivity($ha.hr^{-1}$)

RESULTS AND DISCUSSION

Quantitative losses

(Table, 1) shows the effect of the tractor's speed, the speed of the chain conveyor, the type of chain conveyor, and the overlap between them on the quantitative losses when by increasing the tractor speeds from 2.5 to 3.18 and then to 3.60 km $.hr^{-1}$caused an increase in quantitative losses from 1.40 to 2.42 and then to 4.01% respectively This is because when the speed is increased, it increasing the soil resisting to the extraction when working at the high speed and keeping tubers at great depths and this is consistent with the results reached **(Al-Obaidi, 2012; Abdalla *et al*., 2018)**.

Of the same (Table, 1) shows the effect of the speed of the chain conveyor on quantitative losses, as it is noted that the speed exceeded 49 $m.min^{-1}$ in achieving the lowest percentage of quantitative losses. which amounted to 2.41%, while the highest of the percentage of quantitative losses was in the speed of the chain conveyor 43 $m. min^{-1}$ amonted 2.81 %. The also table shows the effect of the type of chain conveyor on the percentage of quantitative losses, where the clothes -coated type of rods outperformed in achieving the lowest value, amounting to 2.53 %, while the highest percentage was in rubber rods, amounting to 2.69%.

Table (1): Effect of tractor speed, chain conveyor speed, chain conveyor type and the overlap between them on quantitative losses.

Indicators	Quantitative losses %			
Practical speed km . hr^{-1}	Chain conveyor Speed m. min-1	Overlap between practical speed and chain conveyor speed and type conveyor		Overlap between practical speed and chain conveyor speed
		Rubber conv	Coated conv	
2.5	43	1.53	1.48	1.50
	49	1.35	1.25	1.30
3.18	43	2.69	2.52	2.60
	49	2.29	2.21	2.25
3.60	43	4.56	4.13	4.34
	49	3.75	3.63	3.69
LSD = 0.05	0.077			
Type conveyor	2.69		2.53	
LSD =0.05	0.044			
Chain conveyor Speed m. min^{-1}	Interaction between chain conveyor speed and type conveyor			Chain conveyor speed medial
43	2.91		2.71	2.81
49	2.46		2.36	2.41
LSD = 0.05	0.044			
Practical speed Km. hr^{-1}	Interaction between practical speed and Type conveyor			Practical speed medial
2.5	1.44		1.36	1.40
3.18	2.49		2.36	2.42
3.60	4.15		3.88	4.01
LSD = 0.05	0.025			

(Table, 2) shows the effect of the tractor's speed, the speed of the chain conveyor, the type of chain conveyor, and the overlap between them on the field efficiency.increasing the tractor speeds from 2.5 to 3.18 and then to 3.60 km .hr^{-1} caused a increase field efficiency from 74.7 to 79.98 and then to 84.80 % respectively The reason for this may be due to an increase in the practical productivity , and this is consistent with the results reached **(Abdalla *et al*., 2018; Amer, 2017).**

Of the same (Table, 2) shows the effect of the speed of the chain conveyor on field efficiency, as it is noted that the speed exceeded 43 m.min^{-1} in achieving the lowest percentage of field efficiency which amounted to 78.86%, while the highest percentage of the field efficiency was in the speed of the chain conveyor 49 m. min^{-1} amonted 80.79%. The table shows the effect of the type of chain conveyor on the field efficiency , where the clothes-coated type of rods outperformed in achieving the highest value, amounting to 80.07 %, while the lowest was in rubber rods, amounting to 79.58%. this is consistent with the results reached (**Al– Baderi, 2011).** .

Table (2): Effect of tractor speed chainconveyor speed, chain conveyor type and the overlap between them on field efficiency.

Indicators	Field Efficiency %			
Practical speed km . hr^{-1}	Chain conveyor Speed m. min-1	Overlap between practical speed and chain conveyor speed and type conveyor		overlap between practical speed and chain conveyor speed
		Rubber conv	Coated conv	
2.5	43	72.95	73.83	73.39
	49	75.79	76.23	76.01
3.18	43	78.89	79.37	79.13
	49	80.58	81.12	80.85
3.60	43	83.79	84.35	84.07
	49	85.51	85.57	85.54
Lsd = 0.05	0.18			
Type conveyor	79.58		80.07	
Lsd =0.05	0.10			
Chain conveyor Speed m. min^{-1}	Interaction between chain conveyor speed and type conveyor			Chain conveyor speed medial
43	78.54		79.18	78.86
49	80.62		80.97	80.79
Lsd = 0.05	0.044			
Practical speed Km. hr^{-1}	Interaction between practical speed and Type conveyor			Practical speed medial
2.5	74.37		75.03	74.7
3.18	79.73		80.24	79.98
3.60	84.65		84.96	84.80
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 on the qualitative loss tubers when or by increasing the tractor speeds from 2.5 to 3.18 and then to 3.60 km .hr^{-1} causing an Increased qualitative loss from 11.1 to 12.74 and then to 15.18 %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 conevyor and this is consistent with the results reached **(Siddiq, 2006)**.

Of the same (Table, 3) shows the effect of the speed of the chain conveyor on qualitative loss , as it is noted that the speed conveyor 43 m.min^{-1} 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 49 m.min^{-1} which amounted 12.72%, where the clothes-coated type of rods outperformed in achieving the lowest value, amounting to 12.95 %, while the highest percentage was in rubber rods, amounting to 13.15%**(Siddiq & Saad, 2012)** .

Table (3): Effect of tractor speed, chain conveyor speed, chain conveyor type and the overlap btween them on Qualitative loss.

Indicators	**Qualitative losses %**			
Practical speed km . hr^{-1}	Chain conveyor Speed m. min-1	overlap between practical speed and chain conveyor speed and type conveyor		Overlap between practical speed and chain conveyor speed
		Rubber conv	Coated conv	
2.5	43	11.42	11.29	11.35
	49	10.91	10.79	10.85
3.18	43	13.36	13.10	13.23
	49	12.69	12.38	12.53
3.60	43	15.69	15.47	15.58
	49	14.86	14.71	14.78
LSD = 0.05	0.027			
Type conveyor	13.15		12.95	
LSD =0.05	0.044			
Chain conveyor Speed m. min^{-1}	Interaction between chain conveyor speed and type conveyor			Chain conveyor speed medial
43	13.49		13.28	13.38
49	12.82		12.62	12.72
LSD = 0.05	0.015			
Practical speed Km. hr^{-1}	Interaction between practical speed and Type conveyor			Practical speed medial
2.5	11.16		11.04	11.1
3.18	13.02		12.74	12.74
3.60	15.27		15.09	15.18
LSD = 0.05	000.9			

CONCLUSIONS AND RECOMMENDATIONS

From the results obtained above results, it is clear that the lowest percentage of quantitative losses has been achieved in 2.5 km.hr^{-1} which amounted to 1.40 %, and the qualitative losses amounted to 11.1%, and the lowest field efficiency 74.7 %, while the speed of the chain conveyor 49 m.min^{-1} gets the lowest quantitative losses , which amounted to 2.41 % ,while the speed of the chain conveyor was 43 m.min^{-1} The lowest qualitative loss was 12.72%, and the clothes rods had the lowest percentage of quantitative losses , and qualitative

loss. Therefore, we recommend using a potato digger with tractor speed 2.5 km.hr^{-1}, chain conveyor speed 43 m.min^{-1} and clothes coated bars of chain conveyor.

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