The Amount of Soil and Conveyor Length and its Effect on Tubers

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Abstract: A field experiment was conducted in one of the fields of the Technical Institute in Shatrha 2022. This study aims to investigate the effect of amount of soil and conveyor length on damage tubers by using potato digger . Total damage tubers, lifting tubers were studied in this research . Indicator involved three levels of tractor forward speeds (2.54, 2.88 ,3.50 km . h-1), and two levels of conveyor chain speeds (38 , 45) m. min-1 and two level of type of chain conveyor of iron bars and rubber -coated. The complete random design with three replications was used in the research. The results showed that the tractor speed 2.54 km/h gets the total damaged tubers, to 13.18%, and the lifting tubers amounted to 96.11%. while the speed of the chain conveyor 38 m/min gets the lowest percentage of total damaged tubers , which amounted to 16.94% and lifting tubers to 94.58 %. It was concluded that : using a potato digger with tractor speed 2.5 km/h, chain conveyor speed 38 m/min and rubber coated bars of chain conveyor.

Keywords: chain conveyor, tractor speeds , rubber coated ,iron bars

Introduction:

The main objective of mechanical harvesting of the potato crop is to reduce the time and effort and to make the extraction process successful with less loss and less damage to the tubers while increasing production and speed of all operations by choosing the right potato digger for work, This includes the correct calibration, and choosing the tractor forward speed, the conveyor speed and the appropriate depth of extraction(1). (2) One of the most important causes of damage to tubers is due to the quantities of soil carried with tubers during the crop extraction process, which varies according to soil moisture. (3)   Clay soils are characterized by a long period of stay on the conveyor for the adhesion of soil to the tubers, which increases the time needed to get rid of the dust and thus increases the rate of damage due to the frequent strikes on the conveyor compared to dry soil. (4)The damage to the tubers increases with the increase in the vibration of the chain conveyor. This is because it works to remove a larger amount of dust in a short time, so the tubers become without a dirt cushion for the remaining distance from the length of the conveyor Including the addition of star wheels, or lifting some of them on both sides of the conveyor , or replacing the star wheels with others of different shapes and dimensions . (5)found that any damage in potato tubers is due to the failure to adjust the harvesting machines and the extraction rail correctly, and that 93-95% of the soil is shaken before the tubers reach the end of the conveyor, and the damage rate may reach more than 10% .This percentage may be reduced to 5% when properly calibrating the quarry, especially the depth of quarrying, and adjusting the tension of the machine sufficiently to prevent its loose motion .While (6) 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 total damage to tubers. 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. (7) explained that the optimum performance of the harvesting machine is achieved at a tractor speed of 2.8 km. -1 hour and that increasing the speed leads to an increase in the proportion of raised and damaged tubers. (8) Studied the effect of three forward speeds of(3.02, 4.25 and 5.20) km. h-1 and three conveyor speeds (2.30, 3.50 and 4.65) km. h -1 and three angle of tilt of the conveyor (15, 20 and 25)The results showed that the best values were at the speed of 5.20 km. h-1, and the chain conveyor speed is 4.65 km. h-1 , and the angle of the conveyor is 15 degrees, due to the least damage to the tubers.

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 potatoes 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 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 complete randomized block design(CRPD). with three replication in this experiment .The main plot included the tractor's speed in three levels: 2.54, 2.88 and 3.50 km . hr-1 The second factor was the speed of the chain conveyor which has two levels: 38 and 45 m.min-1 and a type of the chain conveyor two levels are iron rods and rubber-coated rods as a sub-secondary treatment using the MF 285S tractor type.

Figure 1. components of potato digger during lifting potato

figure 2.Rubber coted Conveyor bars

Result

Total damage 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 total damage tubers.Increasing the tractor speeds from 2.54 to 2.88 and then to 3.50 km .hr-1caused an increase in total tubers from 13.18 to 17.21 and then to 24.35 % The increase tractor speeds caused an decrease in total damaged tubers.This is because when the speed is increased, it leads to an decrease in the depth of the soil and thus raises a less amount of soil that acts as a protective cushion for the tubers from collisions with each other and increase the mechanical impact of the machine parts on the tubers. This is consistent with the results reached (9) , (10) . Table (1) shows the effect of the speed the chain conveyor on total damage tubers, as it is noted that the speed exceeded 38 m/min in achieving the lowest percentage which amounted to 16.94 %, while the highest percentage of the percentage of total damage tubers was in the speed of the chain conveyor 45 m/ min amonted 19.52 %. The table shows the effect of the type of chain conveyor on the percentage of total damage tubers, where the rubber-coated type of rods outperformed in achieving the lowest value, amounting to 17.63 %, while the highest percentage was in iron rods, amounting to 18.85%. This is consistent with the results reached (11).

Table 1.Effect of tractor speed, chain conveyor speed, chain conveyor type and the interactions between them in total damage tubers.

Indicators		Total damage tubers (%)		
Practical speed km / hr	Chain conveyor Speed m\ min	Interaction between practical speed and chain conveyor speed and type conveyor		Interaction between practical speed and chain conveyor speed
		Rubber conveyor	Orin conveyor	
	38	12.24	2.281	12.26
2.54	45	3.481	4.721	14.10
2.88	38	5.371	6.811	16.09
	45	7.561	19.12	18.34
3.50	38	22.26	22.84	22.55
	45	24.92	27.38	26.15
Lsd = 0.05		0.077		
Type conveyor		17.63	18.85	
Lsd =0.05		0.044		
Chain conveyor Speed m\ min		Interaction between chain conveyor speed and type conveyor		Chain conveyor speed medial
38		16.57	17.31	16.94
45		18.65	20.40	19.52
Lsd = 0.05		0.044		
Practical speed Km/ hr		Interaction between practical speed and Type conveyor		Practical speed medial
2.54		12.86	13.50	13.18
2.88		16.46	17.96	17.21
3.50		23.59	25.11	24.35
Lsd = 0.05		0.025		

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The Lifting 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 lifting tubers.increasing the tractor speeds from 2.54 to 2.88and then to 3.50 km .hr-1 caused a lifting tubers increase from 96.11 to 94.03 and then to 92.37 % Increasing the tractor speed led to increase conveyor speed raising the tubers accompanied by lifting a greater amount of soil may sometimes lead to the displacement of some tubers without raising them this is consistent with the results reached (12).

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 lifting tubers, which amounted to 93.67 %, while the highest percentage of the lifting tubers was in the speed of the chain conveyor 45 m/ min amonted 94.58 %. The table shows the effect of the type of chain conveyor on the percentage of lifting tubers, where the rubber-coated type of rods outperformed in achieving the highest value, amounting to 94.33 %, while the less percentage was in iron rods, amounting to 94.02%.

Taple 2. Effect of tractor speed, chain conveyor speed, chain conveyor type and the interactions between them in lifting tubers %.

Indicators		Lifting tubers (%)		
Practical speed km / hr	Chain conveyor Speed m\ min	Interaction between practical speed and chain conveyor speed and type conveyor		Interaction between practical speed and chain conveyor speed
		Rubber conv	Orin conv	
	38	95.93	95.41	95.67
2.54	45	96.68	96.44	96.56
2.88	38	93.72	93.52	93.62
	45	94.61	94.31	94.46
3.50	38	92.22	91.79	92.00
	45	92.83	92.65	92.74
Lsd = 0.05				0.10
		0.18		
Type conveyor		94.33	94.02	
Lsd =0.05		0.10		
Chain conveyor Speed m\ min		Interaction between chain conveyor speed and type conveyor		Chain conveyor speed medial
38		93.95	93.57	93.76
45		94.70	94.46	94.58
Lsd = 0.05		0.61		
Practical speed Km/ hr		Interaction between practical speed and Type conveyor		Practical speed medial
2.54		96.30	95.92	96.11
2.88		94.16	93.91	94.03
3.50		92.52	92.22	92.37
Lsd = 0.05		0.061		

Conclusions:

From the above results, it is clear that the lowest percentage of total damaged tubers has been achieved in 2.54 km/h which amounted to13.18 %, and the lifting tubers amounted to 96.11 %, while the lowest undamaged tubers was 76.20 while the speed of the chain conveyor38 m/min gets the lowest percentage of total damaged tubers , which amounted to16.94 % The undamaged tubers were 73.05 %, while the speed of the chain conveyor was 45 m/min. The highest lifting tubers were 94,58 %, and the rubber rods had the lowest percentage of total damaged tubers, highest lifting tubers and undamaged tubers . Therefore, we recommend using a potato digger with tractor speed 2.54 km/h, chain conveyor speed 38 m/min and rubber coated bars of chain conveyor.

References

1. Milner, J. B. (1975). A research tool for the investigation of the relative effectiveness of various riddling motions. Journal of Agricultural Engineering Research, 20(2), 217-219.
2. Abdulla, Z.B.A. (2022). Study the effect of forward speed and penetration angle of potato digger on some mechanical damages for two tubers varieties during harvest. M.S. Thesis. Collage of Agricultural Engineering Science. University of Sulaimani .
3. Baritelle , A. ; G.M. Hyde ; R. Thornton and R. Bajema. (2000). Classification system for impact related defects in potato tubers Am . Journal. Potato Res. ,. 77, 143-148
4. Siddiq, A. M.A. S. (2006) Development of the separation device in the potato (Solanum tuberosum) digger and its performance evaluation of a PhD thesis, Department of Agricultural Machinery and Machinery - College of Agriculture and Forestry - University of Mosul. Iraq.
5. Ibrahim, M. M., Amin, E. and Farage, A.(2007). Developing a multipurpose digger for harvesting root crop digger. Miser J . A g. Eng, 25 (4): 1225-1239
6. Muhammad, Y., Mehmood, A. M., & Rehman, R. (2003). -Design development and performance evaluation of rotary potato digger. AMA, 34(2), 43-46.
7. Mahmoud, M, M. A. J. (1992). Mechanization of potato harvesting under Egyptian conditions (Master's thesis) Mansoura University, Arab Republic of Egypt.
8. Arfa , G.K.. The effect of harvesting operation on potato crop handling Misr Journal. Agricultural .Engneering .2007 , 24(3) :492 -503 .
9. Abdalla, N.O. Kheiry, Amgad E. Abbas E. Rahma,Myara A.M.(2018). Elnogomi A, Hu Dong.Yuan.L.Effect of operation variables of potato digger with double chain conveyors on crop handling and machine performance .International Journal of Environmental .ISSN:2454-1850 , Vol -4, Issue- 6.
10. Zhyar, B.A., Arkan, M.S. , Fawzy, F.Kh.(2022).Effect of forward speeds and blade angle pf potato digger on fuel consumption and tuber mechanical damages .Mesopotamia Journal of Agricultural .N 75 (2204-1170).
11. Ghalib ,A.K.M.(2019). Impact of speed and extraction depths on performance of potato digger .Indian. Journal. of Ecology V46 Special Issue. India . (8):246-250.
12. Sayed, M.S.,Mahmoud , A. M. ,Abdel-Maksoud ,M.A., and Fahd,M.F.(1996).An engineering study on a prototype digger for potato harvesting .Misr.J.Agric.13(1):245-261.