What Speed of Operation for a Potato Digger Causes the Least Amount of Injury[1]

By Thomas E. Long[2]

EVERY Potato grower knows that bruises on his potatoes cost him money due to rot and lower grades. A number of operations during potato harvest account for the total injury. The potato digger is only one source of bruising. This report considers only the digger. The aim of this work has been to determine the most suitable speed of the digger apron to eliminate bruising.

The speed of 47 potato digger aprons was recorded to find a relationship between the speed of the digger apron and the amount of injury.

During the 1942 potato digging season 21 diggers, and in 1943, 26 diggers were checked in the vicinity of Grand Forks, Grafton, Cavalier and Walhalla. The speed of the digger was noted under the conditions at which it was operating when we visited the individual farm.

Ten samples, each weighing approximately ten pounds, were picked up directly behind the digger. The tubers were classified into major and minor cuts, and major and minor briuses. The classification was not done according to the market grades. On the contrary, a more rigid basis of classification of digger injuries was used. Every opening on a tuber was considered. Any bruise longer than one inch was classified as a major bruise. Smaller blemishes were graded as a minor injury. (See Figures 1, 2, 3 and 4.)

The speed of the elevator apron was measured as the digger moved forward. A coupling with a flexible

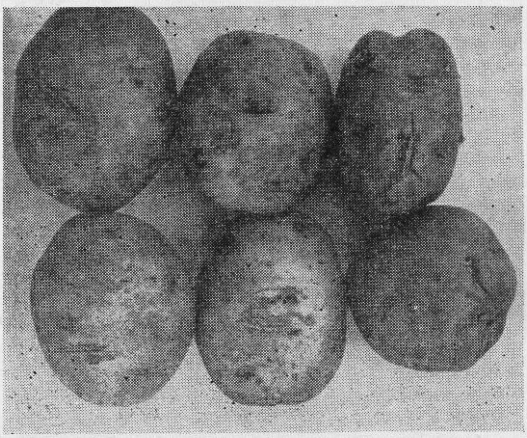

Figure 1—Triumph—Bruise 1 inch or less classified as minor injury.

[3]Christian, C. S. and S. G. Gray. Interplant competition in mixed wheat populations. Journ. Counc. Sci. and Industr. Res. Australia 14:59-68. 1941.

[1]Final report on Purnell Project 93-A "Measurement of Potato Injury Caused by the Potato Digger."

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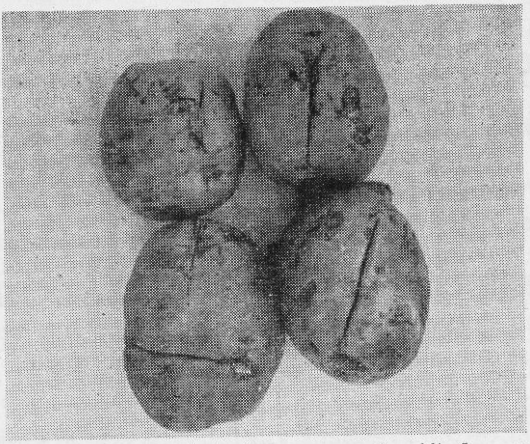
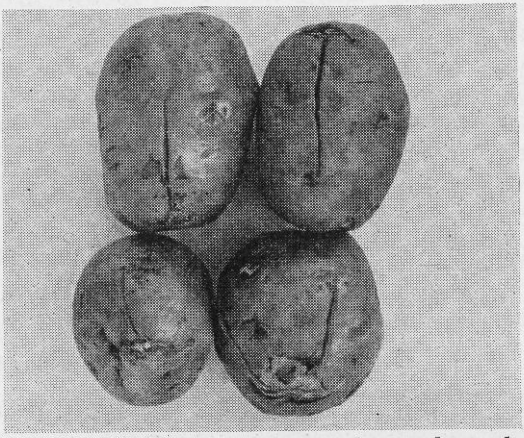


Figure 2—Triumph—Bruise 1 inch or more classified as major injury.



Figures 3—Triumph—Combination bruise and crack classified as major injury.

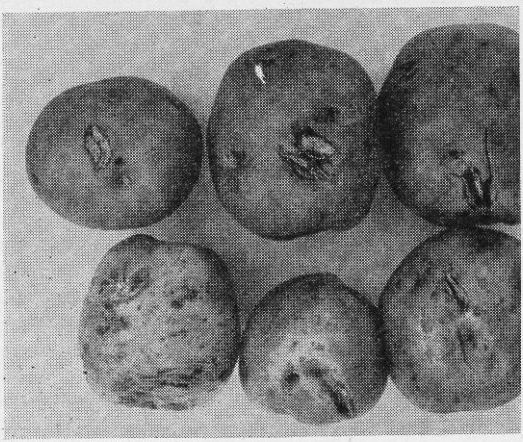


Figure 4—Triumph—Jagged bruise classified as major injury.

cable was fastened to the drive shaft. Three readings, each of one minute, were taken along the row. The speed of the elevator apron was calculated in feet per minute, from the revolutions per minute, number of teeth and pitch of the sprockets.

Combined Results of All Diggers Operating

There was a wide variation in the speed of operation between farms. One farmer would operate his digger at a moderate speed. His neighbor would be operating his digger apron twice as fast.

The bar chart (Fig. 5) shows the average amount of bruising of 47 diggers as recorded for the two years (1942-43) of operation.

This chart indicates a drop in the amount of bruising when the digger apron was operated in the range of 220 to 240 feet per minute. At slower or faster speeds the

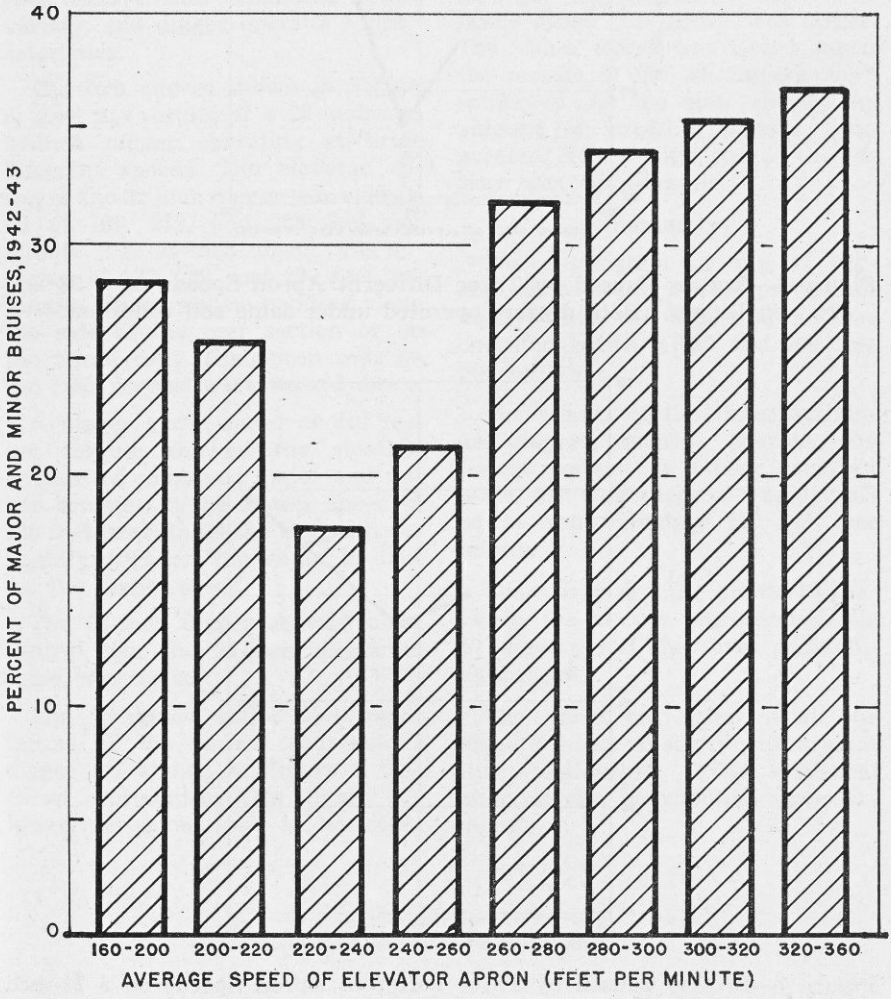


Figure 5—Bruises Caused by 47 Diggers at Various Apron Speeds.

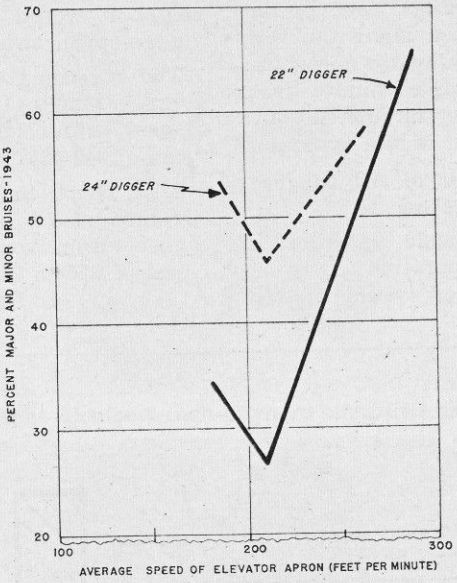


Figure 6—Bruises Caused by Three Diffeernt Apron Speeds on a 22 and 24-inch Digger. (Both diggers operated under same soil conditions.)

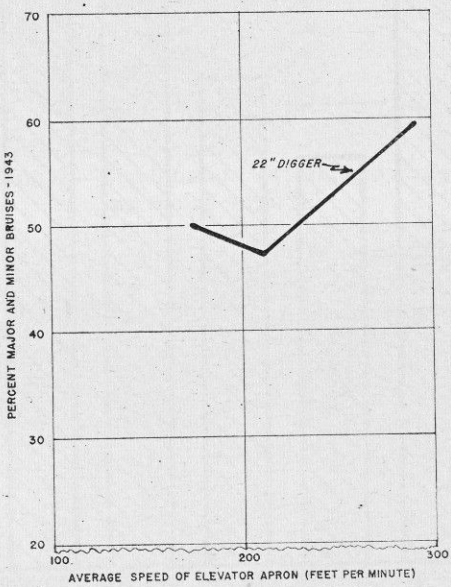


Figure 7—Bruises Caused by Three Different Apron Speeds on a 22-inch Digger. (This digger operated in different locality than shose shown in Figure 6.)

amount of injury was higher. Note the similarity of the curve representing all the diggers and the results on three individual diggers shown in Figures 6 and 7.

Operational Characteristic of Individual Digger

We received the cooperation of two growers in the Nash vicinity, who operated their diggers at three different speeds for us. These trials eliminated the variations due to soil texture, soil moisture, potato variety, and digger operator's characteristics.

The two curves shown in Figure 6, give the results of a 22-inch and 24-inch digger operating at three different speeds. The elevator apron of the 22 inch digger was operated at 186, 212, and 264 feet per minute. The 24-inch digger was operated at 182, 208, and 290 feet per minute. There was no padding along the side of the rear section or on the apron rods. The apron rods on the rear section were turned down.

A digger apron speed of 210 feet per minute showed the smallest amount of combined major and minor bruises. At the slower speed of 180 feet per minute the bruising was slightly higher. The same is true for the higher speed.

The 24-inch digger showed more injury than the 22-inch digger in these two trials.

The combined major and minor injury of the second cooperator's digger are shown in Figure 7. The curve representing this digger followed the same trend as the other two diggers. The injury was less when it was operated in the range of 210 feet per minute. At the slower speed the injury was a little higher. The amount of bruising increased noticeably at the highest speed reading.

Each of these individual diggers, operated at different speeds on the same soil type, showed the minimum amount of bruising when the apron speed was about 200 to 210 feet per minute. At a slower or faster speed the injury was larger. The same trend was noted when the results of the 47 diggers were combined. At the slow speeds the amount of bruising was a little greater. At the high speeds the injury was considerable.

Summary

The summation of the 47 diggers showed the lowest percent of injury when the digger apron was operated between 220 and 240 feet per minute.

The results of the three individual diggers checked, showed the lowest percent of injury occurred when the digger apron was operated at approximately 210 feet per minute.

There is a definite similarity between the curves representing the 47 diggers and the three individual diggers.

The linear regression of all the diggers shows no significant straight line relationship. (The statistical analysis can be supplied upon request.)