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Steps That Can Be Taken to Reduce Mechanical Damage to Potatoes At Harvest Time

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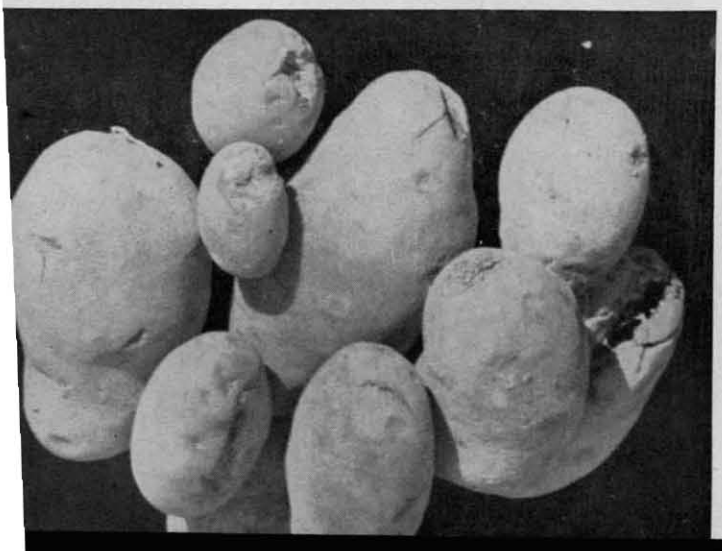
Steps That Can Be Taken to Reduce Mechanical Damage to Potatoes At Harvest Time

Much can be done with the harvesting machinery and equipment that is now in use on the farms to reduce harvesting damage to potatoes. The following suggestions, if properly observed, will reduce mechanical injury.

1. Reduce the field speed of the digger to 1½ miles per hour or less.
2. Reduce the digger chain speed to 150 feet per minute or less.
3. Operate the digger chain with the raised portion of the link ends on the underside or shield them with belting.
4. Replace the kickers with idler wheels if soil conditions permit.
5. Put rubber tubing on the digger chain links.
6. Eliminate all drops of more than 6 inches wherever possible.
7. Put padding on the sacking platform. Use sponge rubber ½ to ¾ inch thick and protect with canvas or old belting. Pad the inside of the sacking hopper with sponge rubber ⅜ inch thick. Rubber padding can be cemented directly to the iron by cleaning the surface thoroughly and using a good rubber cement.
8. Pad the bed of the truck on which potatoes are hauled. Sponge rubber covered with canvas is excellent. Straw covered with sacks is good, or even sacks alone help considerably.
9. Reduce the speed of any transfer or elevator chains to 70 feet per minute or less.
10. Put rubber tubing on all transfer, elevator, and piler chains.
11. Pad the sides of the piler hopper.
12. Handle sacked potatoes with care.



Rot-causing bacteria easily enter potatoes that are bruised and damaged. Such tubers are no longer a high standard product and the grower takes the loss.

In this picture of poorly handled potatoes, rot has completely destroyed a tuber that could have graded U. S. No. 1.

Mechanical Injury

A check of samples from potato cellars located in southern and eastern Idaho showed a high percentage of mechanical injury to potatoes stored there. The mechanical injuries varied from slightly skinned spots to severe bruises that made culls of the tubers. The potatoes checked were probably as good or better than the average for all cellars in their sections. One can go into any average storage bin and try to select 10 potatoes that are entirely free of mechanical injury. To do so is almost impossible. Injury occurs to potatoes in every operation from the digger point to the storage bin.

What injures potatoes? The digger blade is often guilty, as well as the digger chain, a drop after passing over the digger chain, loading, elevating, trucking, unloading, and binning. An observation of any potato harvesting operation will prove this.

The importance of reducing injury often amounts to the difference in the selling price of U. S. No. 1 and U. S. No. 2 potatoes. Mechanical injuries of potatoes cost Idaho farmers many thousands of dollars annually. Few can afford the luxury of unnecessarily damaged potatoes in their bins.

When a potato strikes against the side of a potato digger, a chain link, or any other hard surface, it is usually damaged if it is moving too rapidly. Potatoes should not go up the digger at a high rate of speed nor be permitted to gain velocity by long drops into sacks, piling hoppers, or from the piler into bins. When a potato travels up digger chains or elevators at high speed, it is likely to be stopped suddenly. These stops are usually against hard surfaces, and damage is sure to follow. This means that the potato may easily be reduced to a No. 2 or a cull. When this happens, it is often the owner's loss. *Fast-moving, hard-bumping potatoes take money out of the producer's pocket.*

Air Checks or Rough Handling?

It is true that some potatoes suffer damage from air checking or an excessive pressure within the potato. When this occurs, the potato simply pops open because the pressure on the inside is greater than the pressure on the outside. But most of what is commonly called air check damage can be traced directly to rough handling. If potatoes are handled gently there will be fewer "air checks" throughout the bins.

All potato profits come from the consumer. Continued consumer demand comes only for high quality products.

Field Speed

High field speed results in rapid machine operation and causes considerable costly injury to potatoes. The tubers gain momentum and are damaged when they come in contact with hard clods, with rocks, or with parts of the digging machinery. This is especially true when the potatoes are carrying great amounts of water as they usually are at digging time. SLOW DOWN THE DIGGING OPERATION. A good job of digging can be done at a slow-walking speed from 1 to 1½ miles per hour. At this speed a one-row machine can dig more than a half acre in an hour. A two-row machine can dig more than an entire acre an hour. These figures are based on potatoes planted in rows 36 inches apart.

Potato harvest time is usually short. The operator must figure how long it is going to take him to dig his potatoes and put as many harvesters in the field as he will need to do the job. He should not try to speed up his digger. The damage he will do by excessive speed may cause as great a loss as leaving part of his potatoes in the field.

Digger Chain Speed

A check on a number of diggers and harvesters throughout the potato-growing sections of Idaho showed that digger chain speeds varied from 125 to 300 feet per minute. Most machines operate at about 200 feet per minute. This speed is enough to carry away all dirt and potatoes passing over the point of the digger while traveling through the field at a speed of 2¼ miles per hour. This is too fast for minimum injury. The machine should be operated at 1½ miles per hour and the digger chain operated at an average of not more than 132 to 150 feet per minute.

The use of an automobile transmission to give a range of speed control is not recommended. When the gear box is installed in the line of power flow, accompanying gears or sprockets must have a size that gives correct operating speed in one gear. This gear setting is often intermediate. Then, when a shift is made to high or low, the speed change is too great to be of practical value.

How to Figure Chain Speeds

The digger chain speed on an ordinary potato digger can be reduced by using a larger sprocket on the end of the shaft that drives the digger chain. A sprocket that has two more teeth will often make sufficient speed reduction. To determine the digger chain speed the operator should tie a cloth or marker on a link of the chain and then begin digging at normal operating speed. By counting the number of times the marker passes a given spot on the

Rough-handling potatoes is a luxury! Can you afford it?

digger in one minute, measuring the length of the digger chain in feet, and multiplying the length of the chain in feet by the number of times the marker passes the fixed point in one minute the operating speed in feet per minute can be obtained.

A speed indicator or an r. p. m. counter can be used to obtain the r. p. m. of the shaft that carries the sprocket which drives the chain. The next step is to multiply the r. p. m. thus found by the pitch circumference of the driving sprocket expressed in feet. The circumference can be determined by measuring with a tape or measuring the diameter and multiplying by 3.14 being careful to express the result in feet.

Rubber Covered Links On Digger Chains

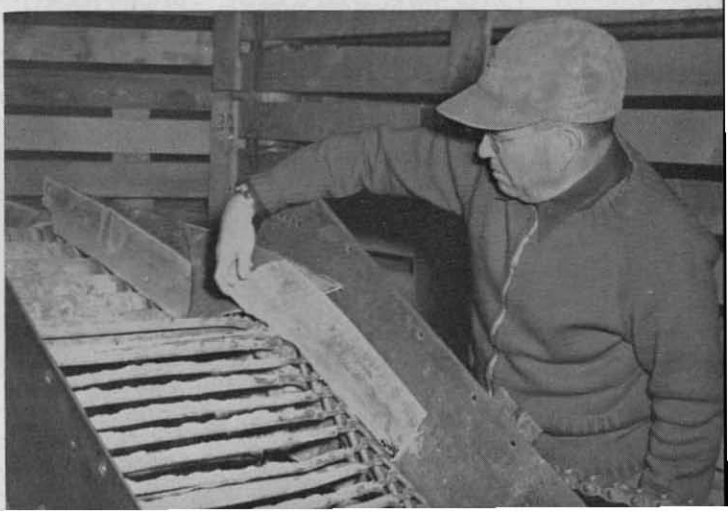
A check on the use of rubber-covered digger chains showed that users were satisfied with them. Samples of potatoes taken from diggers using standard steel chains of 7/16 inch stock showed an average of 15 percent hard bruises. After covering the steel chains with rubber tubing, the hard bruises dropped from 15 percent to 2 percent. Such an improvement in harvest operations means many dollars to the producer.

It is true that digging with a rubber covered chain is sometimes impossible. A heavy rain will cause a chain to coat so badly with soil and mud that it is impossible to use it. At such a time, an uncoated chain should be used. Such emergencies can be met by keeping a spare chain on hand.

The digger chains can be covered with rubber tubing in the farm shop or sent to a commercial concern where the rubber can be vulcanized on each link. If the operator is depending on such service from outside concerns, he should be sure to have this done several weeks or even months in advance of the harvest season.

Digger Chain Injury

What happens to the potatoes going over the machine? First they change from zero velocity as they lie in the field to digger



Turned in, the digger-chain link ends cannot bruise potatoes coming over them. Cover the links with rubber tubing and shield the sprocket with old belting to make sure it does not harm the tubers.

chain speed in approximately one second and in a distance of less than 3 feet. The change is sudden and harsh. If the potatoes are to come through the digging process without injury, their journey must be cushioned. The operator should be sure that the digger point is well below the bed of earth in which the potatoes lie. This allows a cushion of soil to travel along with them for the first few feet of their journey. Such a cushion helps greatly to prevent chain injury. If the soil is light and sandy, it is best to use a rubber covered digger chain and operate it at the slowest practical speed.

The link ends on the digger chain are another problem. Look at the dug potatoes. If they have a peculiar three pointed star-shaped mark, they are getting damage from the ends of the digger chain links. They should be changed so the link ends are turned in instead of out, or a shield used to keep the potatoes from contacting the link ends.

There is a slight mechanical change necessary if the chain link ends are turned in. Such a change necessitates a slightly larger idler and one with straight sides rather than cone shape at the lower end of the digger chain. It must be at least 4 inches in diameter for a chain with a 1½-inch spacing and made of 7/16 inch stock.

An old belt 4 to 6 inches wide can be made into a shield for the link ends by bolting it to the sides of the digger. It must extend in and over the link ends of the digger chain.

In muddy digging the inverted chain may be the only solution to the problem as the shielding will give trouble at times due to clinging mud.

How to Put Rubber Tubing On Chain Links

These suggestions may help the operator in putting rubber tubing on digger chain links.

First of all he must decide whether he will want to remove the tubing from the links and use it again. If the tubing is to be re-used he should buy it 1/32" larger than the size of the chain link, use soap solution as a lubricant for installing, and then cement the ends to the link to prevent slippage. If the tubing is *not* to be resused, it should be bought with the opening the same size as the chain link, and either soap solution or cement may be used as a lubricant when slipping the tubing onto the links. *In either case, soft, tough rubber tubing with 1/8/side walls is best.* Some of the rubber tubing

Use a funnel to fill the rubber tube with the soap solution. See that the soap contacts the entire inside surface of the tube, then pour the excess solution back into the can.

on the market has very thin walls and is not so tough as the heavier tubing.

During the experimental trials, tubing the same diameter as the link was first used, but it was found that this tubing would outlast the chain. If the tubing is purchased 1/32 inch larger than the chain link, it can be taken off the worn digger chain and reused.

The mechanic should be sure to have the rubber tubing good and warm. It will reach the right temperature if it lies in the hot sun on an August afternoon. The tubing should then be cut into lengths slightly shorter than the distance between the drive sprockets on which the chains run.

The next step is to take any good soap powder and mix it with warm water until a *soupy*, slick soap-suds results. Using this solution as a lubricant, the rubber tubing can easily be forced on over the chain links. The pictures illustrate the necessary steps and how to hold the chain links.

Brush some of the soap solution onto the link. Be sure to cover it thoroughly.

One of the best ways to apply the soap solution is by using a pump oil can. Or the solution can be poured through a small funnel into each tube. In either case, the inside of each tube can be coated before the tube is slipped onto the link. Both ends of the tube should be held up as the soap suds is poured. This will make sure the suds contacts the entire inside surface. *It is essential that the hands and the outside of the rubber tubing be kept dry.* Failure to do so will make it almost impossible to handle the tubing efficiently.

Now one end of the link can be clamped firmly in a vise and some of the soap suds brushed on it just before the tube is slipped over the link.

Plant good potatoes, harvest good potatoes, sell good potatoes. IT PAYS!

After everything is in place and the soap has dried, the tubing at each end can be cemented with a good rubber cement so that it cannot change position. The mechanic should be sure to clean the end of the rubber tubing and the steel link where he applies the cement. The cement will not stick unless the metal is clean. Soft, tough tubing with $\frac{1}{8}$ inch side wall is far superior to some of the thick-walled, stiff air hose that has been used in the past.

This job is not difficult if: (1) the rubber tube is properly warmed, (2) the inside of the tube and the outside of the link are covered with thick soap solution, and (3) the hands and the outside of the tube are dry.

Belt and Transfer-Chain Speeds

Whether the elevator and transfer belts are of chain or rubber, they should be operated as slowly as possible. When potatoes leave the transfer chain or belt they are quite free of dirt and foreign material. At this stage then, they do not need to be carried along so swiftly to handle the volume coming up over the digger point. Because there is neither dirt nor vines to cushion them, the potatoes should be handled with less speed and more caution than in the first part of their journey. The potatoes should not strike a link or guard rail at high velocity. Their speed should be reduced to somewhere between 50 and 70 feet per minute. If the capacity of the machine is too low, a wider belt should be installed even though it requires some remodeling. Belts are not usually loaded to capacity with potatoes. Less damage occurs to the tubers on a loaded belt moving slowly than on a fast-moving belt carrying only a thin stream of potatoes.

Transfer chains give the potatoes a softer ride when the links are rubber covered.

Use old belting to cover or shield the link ends.

Harvest and handle potatoes with care. The Difference helps pay digging expenses.

Unloading Into Storage Bin

One operation that inflicts costly damage to potatoes is that of unloading from the truck into the storage bin. Out of 48 samples taken from 16 farms, there was a 3 per cent reduction in the amount of No. 1 potatoes in the storage cellar. The number of hard bruises increased, and many of them later became culls.

This is one of the easiest points at which the operator can correct poor handling methods and stop injury. These steps should be followed to eliminate the greater portion of unloading damage.

1. Slow the piler-chain speed to 50 feet per minute.
2. Put rubber tubing over each link.
3. Pad the hopper with sheet sponge-rubber.
4. Feed the potatoes into the hopper steadily.
5. Handle the sacked potatoes with care. Empty the sacks gently.
6. Keep the delivery end of the hopper a short distance above the pile. Do not allow the potatoes to pile up and drag back down with the piler chain.

Use old belting to cushion and shorten the fall from the truck into the piler's hopper.

Reducing Alfalfa Root Trouble

When green alfalfa roots are present in the potato field at harvest time they may cause trouble and loss of time by clinging on the digger point as well as injuring the potatoes being harvested.

This difficulty can be greatly reduced by adapting to the machine a split, curved digger blade that has the appearance of a "W". If this point is correctly mounted and properly adjusted, roots will pass through the slotted opening in the center of the digger blade without any plugging action. By using two points instead of one, the angle on each point is sharper and roots have less tendency

to cling. If the blade is correctly shaped and mounted, it will dig clean without slicing the tubers and yet actually dig less soil with the potatoes. To do this it should be so shaped and mounted that the digger blade slides through the soil under the potatoes just like a big scoop shovel. By having the blades curved, the potatoes and dirt are fed up the digger chain rather than being shoved around the point and left in the field. The slot opening should be approximately 1½ inches wide. The lower end of the digger will require bracing by welding a cross tie of 2″ x 2″ x ¼″ angle iron about 6 to 10 inches above the lower idlers. The location of this brace depends upon the general construction of the frame and the necessity for proper digger chain clearance.

It is absolutely necessary that this type of point be correctly mounted to secure the desired benefits and avoid disappointment. The center of the blade will be approximately 1 inch lower than a straight line at the rear of blade and the inside heel of the cutting blade is set to dig nearly as deep as the point when lowered into digging position.

A split digger blade helps to prevent alfalfa-root clogging.

The blade is bolted onto a mounting which in turn is welded to an adjustable plate. This allows accurate position control.

The Press Wheel

The use of a press wheel to control the depth of digging and pulverize some of the surface clods is advisable. Many operators have eliminated the wheel and reduced weight, but in so doing they have probably increased the amount of sliced potatoes which automatically increases the amount of culls. If a pin-type hitch is used and a hydraulic lift employed, the press wheel causes no trouble at all.

Good soil, good seed, and good management produce good potatoes. Don't let poor harvesting and poor handling spoil a good crop.

Depth Control

Accurate control of the depth at which a digger point operates is very important if one is to dig with greatest economy of power and yet avoid slicing or cutting the potatoes.

The following three suggestions will aid in securing the desired control.

1. Use a press wheel on the front end of the digger.
2. Fit all joints in the connecting links tight so that there is no free play.
3. Use a ratchet that has half notch control.

The control should be so accurate that the digger point operates without variation at the exact depth at which it has been set.

Some operators feel that the front of the machines can be mounted on the tractor drawbar to eliminate the press wheel. This might be practical on perfectly level ground. However, a high percentage of cut potatoes may result unless the press wheel is in use on rough ground or when ditches are to be crossed during digging operations.

The ratchet with half-notch adjustments gives the operator accurate digging depth control. Some operators fail to make best use of this important equipment. Keep it tight, in good repair, and use it to prevent cut and ruined tubers.

POTATO harvesting has come a long way since the day when growers first abandoned the shovel and rake as harvest tools. The horse-drawn digger is still in use on a few Idaho farms and in many ways still does a good job. With the advent of the highly efficient tractor units, more and more farmers have come to the use of the two-row power digger. Still other potato growers are finding the big, two-row bulk harvester the machine that offers them most in efficiency.

Regardless of how potatoes are dug, one fact is outstanding: The more U. S. No. 1 potatoes growers *send to market,* the greater are going to be the returns from the land, labor, and capital used to produce the crop. Although Idaho has in many ways led the field in the development of mechanical diggers, care in potato handling is still lagging. There is too much difference between the Idaho potato as it comes out of the ground and the condition in which it reaches the consumer at distant points. Although interstate transportation may add to the injuries which the potatoes receive between field and the dining table, it is true that many of these injuries come to them through poor harvesting and handling methods before they leave the hands of their growers.

As competition for markets becomes keener, the Idaho potato must meet an increasingly higher standard if it is to maintain the high reputation it has at present and which it has had in the past. Better harvesting and handling methods will go far to help it reach that standard.