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MECHANICAL INJURY OF POTATOES*

Injuries at harvest time constitute the major grade defect of most lots of Triumph potatoes. During many seasons 30 percent to 50 percent of most lots are damaged so they cannot be included in a U. S. No. 1 grade. These injured potatoes are very susceptible to storage rot. Much of this damage can be avoided if the grower will adjust his equipment and methods to handle potatoes in the best possible way. Some growers have been putting their potatoes in the bin every year with less than 10 percent damage. The grower can realize more from his crop when packed as U. S. No. 1. Practically every grower can adopt many or all of the practices herein described. The principal types of mechanical injury are:

- a. Cuts due to improper depth or inadequate width of blade.
- b. Bruises from very slight bruises that are hardly noticeable to very severe bruises which may involve the crushing of a considerable part of a potato combined with numerous deep or long cracks. These are generally caused by the digger chain or rough handling in picking or hauling.
- c. Cracking or checking often referred to as air cracks may in a very few cases be due to the dry or cold air but almost invariably these cracks have their origin from some mechanical shock - even though it is often very slight. This is the most common and difficult trouble to be overcome in handling Triumph potatoes in September and October in western Nebraska. The causes leading up to it and some preventive measures are discussed in more detail under a separate heading.
- d. Nicks into tubers that gouge out small areas are common in dry years when clods are numerous. They may cause serious losses if storage conditions are not very satisfactory for wound healing.
- e. Feathering or skinning of the potatoes is commonly not taken seriously but has been found to cause serious losses due to shrivelling and rotting, and of course such potatoes cannot be used when bright red washed potatoes are being sold.

All these types of injury may serve as a source of infection with a rot-producing organism and may cause serious losses in storage. They also constitute serious grade defects with a resultant reduction in price to growers.

Tuber Cracking - Cause and Prevention

Cracking of tubers at harvest time is due to the unusually high turgidity of the tubers, which places the potato tissues under such high tension that they crack when subjected to even a mild physical shock. The severity of the crack depends upon the degree of turgidity of the tuber and severity of the shock. For some reasons not understood, potatoes of the Triumph variety seem to be the most susceptible of all varieties to cracking.

*Taken from Nebraska Extension Circular No. 1217 by H. O. Werner. Copies can be obtained by writing H. O. Werner, Nebraska Agricultural College, Lincoln, Nebr.


This condition of extreme susceptibility to cracking is brought about in the tubers by anything that causes a more or less sudden reduction in the amount of water given off by the leaves at the time when the roots are still functioning much more actively. Accompanying or following quickly after such a change there appears to be a very great increase in the amount of water absorbed by the tubers without an accompanying increase in the growth of the tubers. This increased turgidity appears to continue until the amount of water absorbed by the roots decreases considerably either due to the loss of water from the soil or the deterioration of the roots as a result of the dying of the tops. Some of the naturally occurring conditions that bring about tuber cracking are:

- a. A sudden increase in the amount of soil moisture late in the season without an increase in temperature or decrease in humidity.
- b. A sudden decrease in temperature or increase in humidity, either or both of which greatly decrease the rate of water loss by the leaves.
- c. A sudden reduction in the leaf area of the plant due to a light frost or an attack of early blight that destroys some of the leaf area. Cutting off part of the vines or killing them with a spray may bring about the same results for a few days but after that a better moisture balance is restored and tubers no longer crack so readily.

When vines are still almost entirely green, tuber cracking is not brought about as readily as when they are partly mature. Tubers on green vines feather or peel quite readily. Tubers produced on stolons that are partly girdled with rhizoctonia lesions seldom crack.

Most of the cracking of tubers can be prevented by the following methods:

1. Methods to be used in growing the crop or before digging:
 - a. Planting earlier so plants and tubers will be more mature at harvest time. (This may not be desirable because of greater risk of damage by insects and diseases, and because of inferior tuber type and color.)
 - b. Withholding irrigation water after the early part of September.
 - c. Delaying digging till tubers do not crack. Some seasons this may involve delay until a dangerously late date. Much improvement results from a few hot windy days, especially if the soil is not unusually moist.
 - d. Delaying digging several hours on very cold mornings - especially if the air temperature is much lower than the soil temperature.
 - e. Cutting roots sometime before digging by cultivating as deep as possible and as close to the plant as permissible without damaging any tubers.
 - f. Cutting off all roots a day or two ahead of digging by running a potato digger without elevator chain through the field. This will cut the roots but leave vines and tubers in place, the latter covered with soil. The green or partly green vines will continue

to give off water actually removing a small amount from the tubers, thereby reducing their turgidity. The digger blade should be rounded or square on the end and bent so as to run as flat as possible, thus disturbing the soil less than would a steeply sloping blade. Growers using this method in central Nebraska found it desirable to cut a triangular or circular section out of the back side of the blade in this style  so as to disturb the ground as little as possible. For both cutting roots and digging it has been found better to use wheel trucks on the front of the digger. (at the sides of the ridge,) rather than the roller which has a tendency to pull the vines. It may be possible to accomplish root cutting with blades attached to cultivator bars on tractors. It is also possible that most of the desired results can be secured without cutting all the roots. Some patience and ingenuity may need to be exercised to make this method work perfectly under all conditions. If vines are very large and intertwined it may be necessary to cut them back with rolling cutters to prevent clogging of the machine and yanking some tubers out of the ground. This method has not been used in western Nebraska prior to this season. It was first used in central Nebraska in July where it prevented most of the surface peeling or "feathering" of immature potatoes attached to entirely green vines.

- g. Vines can be killed by spraying with acid or other substances - but this must be done well in advance of digging as it may actually cause an increase in cracking for a few days or a week after which roots die and tubers become more resistant. The use of acid involves special spray equipment and must be used with caution. Anyone desiring to use this method may secure information about it from the Department of Horticulture.

✓ COOKING-QUALITY TESTS UPON POTATOES

W. E. Pyke

Those characteristics of potatoes which are recognized as desirable or undesirable vary somewhat according to the use to which the potatoes are to be put. Moreover, there is at present no single perfect variety which embodies all characteristics considered desirable. Actually some characteristics considered desirable in potatoes for certain uses are considered as rather undesirable for other uses. This means that the dream of the plant breeder to produce the perfect all-purpose variety of potato is becoming an illusion. Rather it becomes necessary to study the characteristics of the several varieties of potatoes that make them desirable for a particular use. Moreover, since soil conditions, climatic factors, and cultural practices all exercise influences which alter the characteristics of potato varieties, the problem resolves itself into a study of the various quality characteristics of each variety of potatoes grown in each major potato producing area.

Industrial users of potatoes often buy in large quantities and by contract. Growers who have produced varieties especially adaptable to these uses and who have been willing to handle and store these in such a manner that they have given desired and uniform results have received a premium price for their product. Here again we have a recognition that a certain variety grown in a given producing area with specified cultural, handling, and storage practices shows characteristics that adapt it well to a particular use. The assurance that such potatoes will display the qualities desired has dollars-and-cents value to the user.

In general the earlier varieties of potatoes are somewhat lower in food value per hundred pounds than the later varieties. This does not mean that these varieties are inferior. They have the typical characteristics of the variety. They also serve to lengthen the potato marketing season in many producing areas. This in itself is a contribution toward the economic welfare of that producing area and its markets. It may be that these potato varieties are not those that will be chosen by most consumers throughout most of the year. It is evident, however, that they have a certain definite place in potato production. They fill a definite need.

From the foregoing remarks it is evident that it is important to have quantitative measures of the various cooking and other use characteristics of the various commercial varieties of potatoes. Some such measures have been developed; others are now in the course of development.

It is even more important and useful to have such quantitative measures available in potato breeding and other potato research programs. Such measures have been very important at the Colorado Agricultural Experiment Station in evaluating the resistance of commercial and new varieties to psyllid injury. This work has been carried on in cooperation with Dr. George M. List of the Entomology section. In a similar manner the effect of various fertilizers, trace elements, dates of planting, and so forth, upon different varieties of Colorado-grown potatoes have been evaluated in cooperation with Dr. John McLean of the Horticulture Section.

There is another very valuable application of these quality measures. The Katahdin variety yields potatoes with undesirable characteristics in several large potato producing areas. When grown in Colorado the characteristics of this potato agree closely with those of the Russet Burbank. If there were no way to characterize the various qualities of potatoes, Colorado-grown Katahdins would bear the stigma of its poor behavior in these other areas to a much greater extent than it does.

As the industrial processing and utilization of potatoes increases, the demand for relatively simple means of characterizing their various qualities will increase. Large commercial buyers now require cooking tests before purchases are made. These trends are healthy. Properly handled they can contribute much toward the recognition of high-quality Colorado-grown potatoes.

SHIPPING WASHED POTATOES FROM CENTRAL NEBRASKA AND NORTH-EASTERN COLORADO DURING JULY AND AUGUST 1942*

A. D. Edgar

The sun need not be bright to cause tuber damage in the field.

Considerable damage was done to potatoes by exposure to air when the temperature was much less than that which is generally considered necessary to cause damage. The temperature rose gradually from 63° F. at 9:15 a.m. to 75° F. at 5 p.m. (the highest temperature of the day). Wind velocity was 8 miles per hour in the morning and 3 to 4 miles per hour in the afternoon. The necessity of prompt picking is demonstrated by the high percentage of damage when potatoes were exposed as little as 15 minutes. It is quite evident that sacks did not provide very much protection and it is a mistake to leave sacks in the field on a windy sunny day as much as

*A cooperative study between U.S.D.A., Nebraska and Colorado Agricultural Experiment Stations.

1 hour even if the temperature is not very high.

Table 1. Gilcrest, Colo. Effect of exposure in field and in sacks left in field in causing browning or scalding of Triumph potatoes exposed Aug. 13, examined Aug. 15.

Method of exposure	Length of exposure Minutes	Browning and scald spots on skinned areas		
		Dug 9:15 a.m. Per cent	Dug 1:15 p.m. Per cent	Dug 4:15 p.m. Per cent
Not exposed	0	0	8.6	0
Open in field	15	31.4	89.5	2.9
" " "	30	51.3	88.5	69.1
" " "	60	75.9	93.4	93.9
In sacks	60	29.9	37.1	--
" " "	120	58.6	62.5	--
" " "	240	73.2	45.5#	--

#By error this was a tightly woven instead of loosely woven bag.

In another test when potatoes were dug at 6:15 p.m. and left spread out in the field over night 23.7 percent of the tubers showed browning. When they were stored over night in a sack in the field 16.2 percent of the potatoes showed browning. Dry windy air can do a great deal of damage even when the sun is not shining or the air is not hot.

Field damage has been much more serious on the markets with the white-skinned varieties than with the red-skinned varieties. However, the number of comparable tests with these two varieties has been insufficient to warrant drawing a definite conclusion about these varieties.

Types of Bags

Because of the burlap shortage six types of bags were tested as to their suitability for shipping early potatoes. Some difference occurred in the amount of bruising suffered by potatoes in different type sacks.

The coarse mesh or net bags always injured more of the outside potatoes because the threads made imprints on the tubers or cut into the tubers. This was so in the layer next to the floor or side walls. Most buyers objected to this type of bag but some liked them because they could inspect the potatoes without opening the sacks. These net bags are not suitable for white potatoes since the light admitted through the coarse mesh caused the potatoes to turn green while being handled or displayed in warehouses or stores.

The cotton sheeting bags showed water and soil spots too readily. This created prejudice against them because buyers always suspect spots on bags to be due to decay. It seems that colored or unbleached fabric might be more serviceable.

The Victory cloth bag was probably next to the burlap bag in desirability. It was colored a serviceable light brown that did not show much spotting. The Osnauburg bag had coarser mesh than sheeting bags but not as coarse as the Victory cloth bag; because of lighters color it showed spotting rather badly.

There was little difference in the amount of weight lost by potatoes in different types of bags. The potatoes in the net bags lost most and those in the cloth bags lost least weight, but the differences were very small.

General Conclusions From Transit Experiments

Cooling potatoes promptly after loading was found to be very important in controlling development of decay during transit.

Wet potatoes that are loaded warm and remain warm for several hours provide excellent condition for infection of injuries by rot-producing organisms.

Potatoes loaded in pre-iced cars or potatoes that were cooled by artificial refrigeration as soon as loaded (commonly called precooling) both gave good results.

Cars that were pre-iced showed less decay upon arrival in Chicago than pre-cooled cars that were iced in transit - but after being held for a week there was no apparent difference in the samples of tubers from each type of treatment.

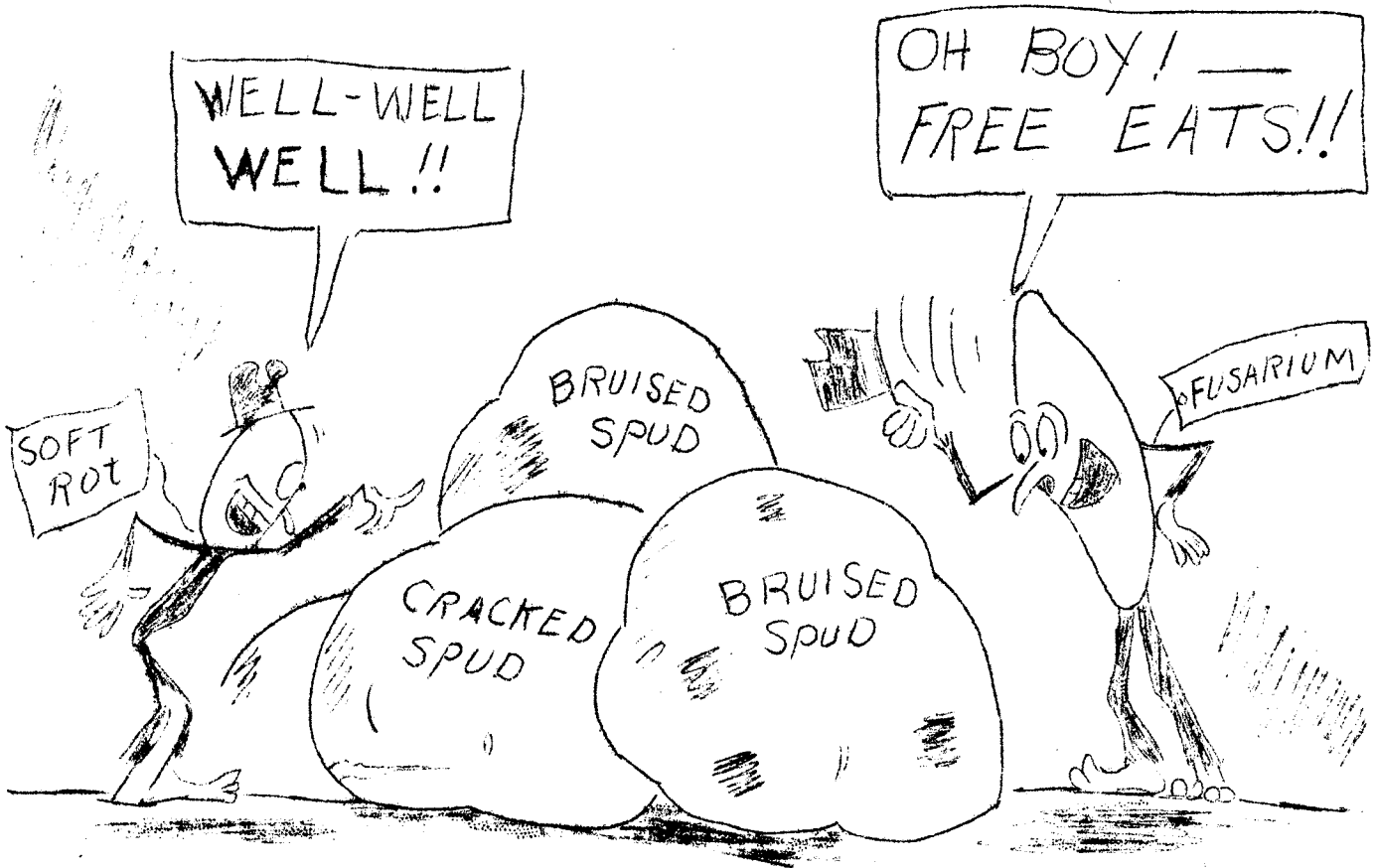
If only condition on arrival is considered, it appears that there was no advantage in re-icing cars that had been pre-iced unless they travelled farther than Chicago -- where they arrived on the third morning. However, most buyers like to have a considerable quantity of ice in the cars on arrival at Chicago so cars can be held better for more advantageous selling. Re-icing may also be necessary if there was much loss of ice before the car was loaded.

The 1942 tests indicated that the average temperature of the load during transit need not be below 60° F. if the potatoes are of good quality and are handled carefully.

(The tests conducted in 1941 showed that standard ventilation was very hazardous with washed potatoes shipped in midsummer. Cooling with artificial refrigeration before shipping or icing shortly after the cars began to move were the most satisfactory methods in those tests.)

SPUD GROWERS

There was some confusion in the mailing list for July SPUD NOTES, especially in Weld County. We hope this will not happen again. Those of you who missed the July issue or wish any of the back numbers can obtain them by dropping a postal card to the Horticulture Department, Colorado State College at Fort Collins. The July issue contained: "Irrigation of Potatoes" by W. C. Edmundson; "Late Blight Condition" by L. A. Schaal; "The Potato Flea Beetle Is the Chief Concern of Many Potato Growers in Colorado Now that the Psyllid Is Being Satisfactorily Controlled" by L. B. Daniels.



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