

HANDLING AND SHIPPING OF POTATOES--LOCAL HANDLING PRACTICES

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Potatoes shipped from Washington must be superior in quality to potatoes shipped from all other production areas if we are to continue to build our markets. Any measures that could be used to reduce injury to potatoes, or to minimize handling expenses must be carefully investigated and evaluated. If these measures are shown to be effective, they must be incorporated into the handling procedures in an economically-feasible manner.

Labor-saving equipment, and the people who operate it, are responsible for all of the handling injury to potatoes. In most cases, it is possible to improve equipment. It is very difficult, and sometimes impossible to improve the human element. Anyone trying to improve methods of handling must be cognizant of this situation. He must attempt to design new equipment and develop handling techniques which will perform the desired task in spite of human failings.

Harvesting Potatoes Into Water

In the Columbia Basin one sees all sizes and shapes of truck beds being used to haul potatoes from the field to the shipping shed. Many of these truck beds are in dire need of repair. This situation makes it necessary for the digger operator and the truck driver in the field to treat each truck bed differently and to vary the loading procedures accordingly. However, as the long working day wears on, it becomes more difficult for the digger and truck operators to give thier undivided attention to specific differences in either design or condition. Fatigue leads to carelessness and carelessness is responsible for a large part of the harvesting injury to potatoes. Inexperience on the part of either operator, as well as differences in digger construction, also contribute to tuber damage. These harmful influences can be partially overcome by loading potatoes into water.

The most serious tuber damage occurs at the start of the loading operations. At first the distance of free fall for potatoes dropping from the loading conveyor to the truck bed is quite long. The greater the free fall, the greater the impact as one tuber hits another or strikes the hard truck bed. In general a greater impact results in more serious tuber damage. Owing to the roughness of the field or mechanical limitations in either the tractor or truck, it is impossible to keep these vehicles oriented in the same position with respect to one another for any extended period. Any variation in the speed of either vehicle will cause the conveyor to move forward or backward from the desired loading position, increasing the distance of free fall for potatoes dropping from the conveyor to the load. When harvesting into water, careless or uncontrollable variations in either the height of the conveyor or the backward and forward motion of the conveyor with respect to the truck bed will not result in appreciable tuber damage. Water will protect potatoes until they are loaded up to the level of the throwdown side. Water is then released and the load is topped off dry.

Two year's data were obtained from experiments conducted in cooperation with the Anderson Produce Co., Othello, Washington. Results showed that potatoes were injured less by harvesting into a truck bed containing water than by harvesting into truck beds lacking water. The more complete data from last year are shown in the following table:

	Amount of tuber disorders due to:		
	Conventional Truck	Water Truck	Percentage Points Difference
Percent of externally-damaged tubers ¹ ₂	5.4	0.1	5.3
Percent of blackspot-blemished tubers ²	29.3	0.0	29.3
Numbers of blackspot blemishes ³	110.0	2.0	108.0

¹Percentages based on the average of 40 samples of 30 pounds each. Damage refers to any external defect which cannot be removed without a loss of more than 5 percent of the total tuber weight (including peel).

²Percentages based on the average of 40 samples of 30 pounds each.

³Numbers of blemishes per 125 tubers in samples taken from each of 8 truckloads.

There are several benefits to be gained by harvesting potatoes into water:

1. Water cushions the fall of tubers into the truck bed reducing both external and internal injury.
2. Water is readily available in the field.
3. Potatoes are pre-washed.
4. Contact burns on tubers harvested into hot steel beds will be eliminated.
5. With the use of water, no movable parts are needed for unloading potatoes at the shipping shed. Therefore, the initial cost of the beds and their maintenance should be less. In addition, floating potatoes out of the truck bed should result in less injury than moving them out of the truck by mechanical conveyances. This would be especially true if the rubber was worn off the chains or if the chains were in need of repair.

Along with benefits, problems are also associated with this method of handling:

1. Unless special facilities are developed, potatoes must be unloaded into water. This limits the use of water trucks to shipping sheds which have these facilities.
2. Water must be diverted from the flume recirculator in a volume sufficient to move potatoes out of the truck bed. This requires additional equipment and modifications in unloading facilities.
3. A water pump, probably mobile, would be necessary to supply water to the truck beds in the field. This would be an additional expense.

More studies on truck-bed design and development of accessory equipment, as well as extensive physiological investigations on the effects of water on tuber condition, must be completed before this method of harvesting can be considered as a regular production practice.

Shipping Potatoes in Bulk

The over-all value from injury reductions brought about by improving any one operation concerned with harvesting, grading, or shipping potatoes is usually dependent upon the efficiency of other handling operations. Each step of every operation must be thoroughly studied and carefully evaluated; first as a separate entity, and then as an integral part of the over-all handling procedure. In addition, production, handling, and shipping costs must be considered when developing new machinery or improving methods of operation. Often a certain technique will be well suited to perform a specific job, but it cannot be put into use because of economic considerations. Therefore, not only do potatoes shipped from Washington need to be improved in quality in order to reduce grade-out losses, but handling costs must be minimized so the shippers of our state can sell potatoes at a price which is in direct competition with neighboring production areas and which is profitable to both growers and shippers alike. It was felt that bulk shipments of potatoes would accomplish both of these objectives.

A bulk potato-shipping experiment using one of the Bangor-Aroostook Railroad bulk potato cars from Maine was completed during January, 1962. Fifty thousand pounds of Russet potatoes were shipped from the Skone and Connors Produce Co. warehouse in Warden, Washington, to the Campbell Soup Company plant in Sacramento, Calif. This study was conducted to observe and evaluate the mechanical operations of the loading and unloading equipment in the car and to determine if the construction of this car was suited to the needs of Washington shippers. Another purpose of this test was to collect detailed temperature data (free space and tuber temperatures) to determine the efficiency in movement of warm air throughout the load. The car was heated by an underslung charcoal heater and the movement of warm air was by convection.

In general, the operations of the car, both loading and unloading, were fast and efficient. The warm air movement, as indicated by continuous temperature recording instruments as well as tuber temperatures taken in sample areas throughout the load, was uniform in all areas of the car.

At the time of unloading, six days after the car was loaded, small patches of mold were noted on a few potatoes at the upper-most surface of the load. This mold was not found anywhere within the load and it appeared to be an easily-removable surface mold having no effect on potato quality. However, further laboratory studies are now underway to determine the relationship of this mold to rot in potatoes.

From the standpoint of our studies, this experiment was a success. However, the results of this trial do not imply in any way that similar summer shipments would be as successful. We know that summer shipments will be subjected to problems quite dissimilar to those encountered in winter shipments, and that these problems will likely be much more difficult to overcome. Nevertheless, this study gave us valuable experience in the operation of the loading and unloading equipment. We also learned more about the placement of test equipment in the load and the best methods for collecting tuber samples for injury analysis. The data collected in this study should give us a better chance of successfully shipping potatoes in bulk potato cars next summer.

The general consensus of opinion on the mechanical operation of this car, by those present at both the loading and unloading, was very favorable. The most serious objection to this car was the permanent installation of equipment. Unless bulk potato shipping cars are constructed in such a way that they can be readily converted to handle common backhaul supplies into our area, they will not have the support of the railroads.

Bulk shipping offers several advantages over shipping potatoes in sacks:

1. By using conveyors to move potatoes directly from the grading machine into the railroad car, the long free-fall distance for potatoes being dropped into the bottom of the sacks and the rough handling of sacks by the stackers will be eliminated. This should reduce the incidence of bruising and blackspot injury.
2. Reducing the number of laborers would cut handling costs.
3. Expensive sacks would be eliminated.
4. Large quantities of potatoes (50,000-60,000 pounds) could be shipped in bulk cars. When compared with the quantity which can be shipped in standard carloads of sacked potatoes (43,000 pounds), this could result in a substantial freight-rate reductions.

Several problems are associated with shipping potatoes in bulk:

1. Bulk shipping would require two complete conveyor systems, one for U.S. No. 1's and one for U.S. No. 2's, so that both grades can be sorted and loaded simultaneously. This would be an additional expense to the shipper.
2. It is likely that only the very large chain stores either now have or could afford to develop adequate facilities at this time to handle potatoes shipped in bulk cars. This could limit the outlets to which a shipper, who is equipped entirely for this method of shipping, could sell his potatoes. Many chain stores want to do their own packaging. On the other hand, smaller buyers often do not have equipment for packaging and they must depend on the shipper to furnish them with potatoes in the desired containers ready for the retail markets. This would make it necessary for shippers to maintain packaging equipment as well as conveyor systems for bulk shipping.
3. If a shipper who is planning to do both bulk shipping and custom packaging reduces his labor force while loading bulk cars of potatoes, he may encounter difficulties in finding the additional help needed to fill packaged orders at another time.

Only a few of the advantages and disadvantages associated with bulk shipping of potatoes are listed in this report. Experimentation will bring out more.

It is clearly understood that in working with a large and diverse industry, any new approach used to solve a given problem cannot possibly be seen as a benefit to the entire industry, at least in its initial phases. What may appear as an advantage to some individuals may be a decided disadvantage to others. However, as a problem is studied more intensively and new information is obtained and published, improvements in other practices relating to it will also be advanced. Problems which may now appear as insurmountable may be only a matter of routine a few years hence. The actual value of any research work, however, depends very much on your interest and abilities. As an individual grower or shipper, you alone must evaluate all of the data that are presented and screen out and put into practice the operations that will help to solve your specific problems. Only through systematic improvement of your individual operations can the entire potato industry of Washington grow and prosper.