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Marketing Potatoes for Consumer Approval

Summarized By

CLAYTON P. LIBEAU

Department of Agricultural Economics

WESTERN REGIONAL RESEARCH PUBLICATION
WESTERN REGIONAL POTATO-MARKETING PROJECT

University of Idaho Agricultural Experiment Station

in cooperation with

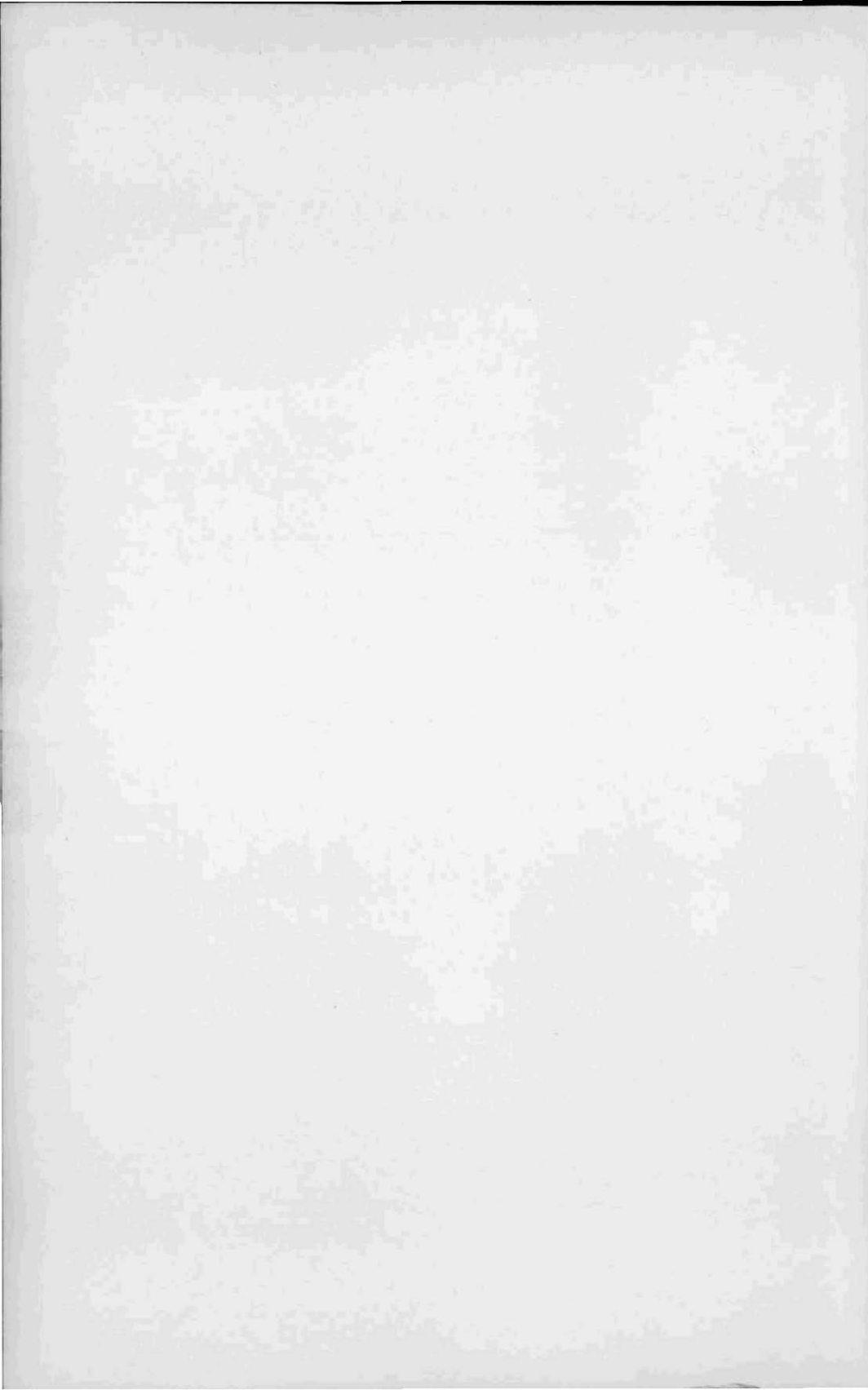
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MARKETING POTATOES FOR CONSUMER APPROVAL

University of Idaho Agricultural Experiment Station
Colorado Agricultural Experiment Station
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and the
Bureau of Agricultural Economics
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and Agricultural Engineering
Production and Marketing Administration
of the
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BULLETIN

University of Idaho
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**WESTERN REGIONAL RESEARCH PUBLICATION
WESTERN REGIONAL POTATO MARKETING PROJECT**

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Director, Washington Agricultural Experiment Station

This bulletin is a summary of the Western Regional Potato Research conducted under the Research and Marketing Act of 1946 in Idaho, Oregon, and Colorado, 1947 - 1950

This research was financed from funds supplied by the Research and Marketing act of 1946. Quality size and defect studies were cooperative projects of the Federal-State Inspection Service, Department of Agriculture and the Production Marketing Administration, U.S.D.A., State Departments of Agriculture and the Experiment Stations. Major contributions to the studies were made by Milton Eberhard, Clifford Davis, and Elmer Humphrey of the Idaho Agricultural Experiment Station; Robert W. Wilcox, Idaho Extension Service; Robert Kunkel and C. R. Creek of the Colorado Agricultural Experiment Station; George B. Davis and Gerald Korzan of the Oregon Agricultural Experiment Station.

* The Production and Marketing Administration in cooperation with the Idaho State Department of Agriculture participated in the inquiry that ascertained the proportion of different sizes of potatoes produced in Idaho in 1947 and 1948.

Marketing Potatoes for Consumer Approval

Summarized by

CLAYTON P. LIBEAU

A Summary of the Western Regional Potato Research Conducted Under
the Research and Marketing Act of 1946 in Idaho,
Oregon, and Colorado, 1947-1950.

Potato Marketing Studies Conducted In the Western Region

(See bibliography, page 24)

1. Quality Loss in Marketing Oregon Early Crop Potatoes

In August and September, 1948, two carloads of potatoes were shipped from Malheur county, Oregon, to Chicago. They contained samples for this study. Each car contained 25 100-pound sample sacks of potatoes graded as U.S. No. 1, size A. These experimental potatoes were shipped under standard refrigeration and subjected to normal handling procedure. A regular inspection was made of each sample at the shipping-point, and they were re-inspected by the same inspector at the unloading point to determine quality loss.

2. Significance of Quality Loss in Marketing Early Idaho-Oregon Potatoes

Samples of early-crop U.S. No. 1 Idaho - Oregon potatoes were shipped in 14 cars under standard refrigeration to two terminal markets during late July, August, and early September, 1949. Eight cars moved to Chicago and six moved to Des Moines. Each car contained 12 100-pound sample sacks which were inspected and placed in the car according to a predetermined loading plan. These samples were inspected again upon arrival in the terminal market to determine the kind and amount of transit damage.

3. Quality Loss in Trial Shipments of Idaho Late-Crop Potatoes

A sample of 12 100-pound sacks of U.S. No. 1 potatoes were examined out of each carload in this study. Data were secured

from samples included in 11 cars shipped in January and February, 1950, under regular heater service from Idaho Falls to Des Moines and Indianapolis. The Idaho State Department of Agriculture assigned inspectors to make inspections at the shipping point and terminal markets.

4. Shipping Injury to Colorado Potatoes

Test shipments of 100 100-pound bags were shipped from the Greeley area in Colorado to Chicago during February and March, 1950. The loading procedure developed for the regional committee was followed. Samples were inspected in detail for external defects resulting from handling, grading, and packing operations.

5. Consumer Preference for Sized Idaho Russet Burbank Potatoes

Potatoes sorted according to size were offered for sale through cooperating retail stores in Los Angeles, Cincinnati, and Kansas City during the winter months of 1948 and 1949. These potatoes were sorted by a cooperative marketing association located in Idaho Falls for the Los Angeles market and by a private potato packer in Aberdeen for the Cincinnati and Kansas City markets. The University of Idaho supervised the sorting.

In the retail stores, the displays offered were made as realistic as possible. Only Russet Burbank potatoes packed in 10-pound mesh bags which were not included in the experimental displays were eliminated from the customary supply in the cooperating stores. In all instances, housewives had other choices not only from the Russet Burbank displays but from competing bulk bins and from other varieties in 10-pound mesh bags. Consumers' preferences were determined from the voluntary purchases of consumers.

6. Consumer Preference for Colorado Potatoes

A consumer opinion survey on potato purchases was made in three retail grocery stores in Denver from February 11 through March 9, 1948. A total of 5588 personal interviews were conducted with consumers at the time potatoes were purchased.

7. Gravity Grading Potatoes

A test of consumer acceptance of specific-gravity graded potatoes was conducted with 2765 pounds of Bliss Triumph potatoes in Fort Collins and Loveland, Colorado, in the winter of 1948-1949. Consumers made 365 purchases from 5- and 10-pound mesh displays used in the study. Purchasers' names and addresses were obtained for future interviewing.

The potatoes used in this study were separated by a gravity grading machine designed and developed for specific-gravity grading. Tubers were separated into two groups; those with a specific

gravity 1.085 and above, which were classified as baking; and those with a specific gravity of 1.080 to 1.085, which were classified as boiling.

8. Defects, Quality, and Size of Potatoes

In 1948 a survey was made with Idaho Russet Burbank potatoes in storage to determine defects, quality, and size of tubers in the potato crop. The survey was designed to provide information on the proportion of tubers graded as U.S. No. 1, U.S. No. 2, and culls. The U.S. No. 1's were sub-divided into various size groups, and the relative importance of each grade defect in No. 2's and culls was determined.

Samples were taken from 273 growers' bins, representing a total of approximately 140,000 bushels of potatoes. The number of bins sampled in each area was selected according to the relative volume of potatoes shipped from each area during the 1947-48 marketing season. A representative sample was selected from each bin examined.

In February and March, 1950, the Colorado Experiment Station made an analysis of tuber size in commercial potato shipments. Samples of Red McClure shipments were given a detailed inspection for size of tuber in the U. S. No. 1 and U.S. No. 2 grades. Tubers classified as U.S. No. 2 and culls were examined to determine the types of defects causing them to be placed in these respective grades.

Quality Loss In Marketing Potatoes

The Western Regional Potato Marketing Research conducted in the last several years shows conclusively that serious potato quality loss occurs in practically every operation from harvesting until potatoes reach the consumer. Studies that reveal where the damage occurs can show growers, handlers, and dealers how to cut down this damage and improve quality.

There seem to be some areas in the production and marketing processes where the potato industry can improve potato quality. In the consumers' preference study prepared by the Bureau of Agricultural Economics, 1948, homemakers said they evaluated quality as the most important item when buying potatoes. Size rated second in importance, price third. Of the total number interviewed, 44 percent said they buy less potatoes when potatoes are of poor quality, even if the price is low. Over half reported they buy less when there is a combination of poor quality and high price. In all the cities included in the survey, more than three-fourths of the homemakers said they had found some bad potatoes that could not be used in their purchases. Consumers are free to reduce

their consumption of potatoes when the quality does not meet their standards. Housewives do not like to buy food they cannot use even if it comes in small percentages of the total quantity purchased.

Quality Studies Show that Grade Defects Are Relatively High Before Potatoes Leave Shipping Point

Federal standards for U.S. No. 1 potatoes permit a tolerance of 6 percent by weight of each type of defect or combination of defects except soft rot for which the tolerance is 1 percent. Samples from 14 cars in the study of early Idaho - Oregon tubers show that total defects average 6 percent in 40 percent of the sample sacks inspected at the shipping-point. Earlier studies conducted in Oregon in 1948 show that samples in half of the cars inspected exceeded the maximum tolerance allowed for U.S. No. 1 grade at shipping-point.

In the quality study of the Idaho late crop, samples from 11 cars had an average of 13.4 percent total grade defects at the shipping-point which counted against grade. Mechanical damage amounted to 7.7 percent while all other defects were 5.7 percent.

Practically all quality investigations up to this time, regardless of geographical location and season of crop, submit conclusive evidence that approximately 6 percent of the potatoes are defective at the shipping-point and most of the samples fall within a range between 3 and 9 percent. Examinations of the Production and Marketing Administration in 1949 revealed that on the average, potatoes contained 7.4 percent external grade defects in the total quantity sampled at shipping-points of Long Island, New York. More than half of the defects at shipping-point are usually cuts and bruises - the types of defects that arise from harvesting and handling and could possibly be reduced considerably by careful handling and grading.

Increase in Grade Defects from Shipping Point to Terminal Market

Total grade defects in the Idaho - Oregon early potato samples shipped to Chicago and Des Moines from the eastern Oregon - western Idaho area increased 5.7 pounds per 100 pounds. Weight of defects averaged 6 pounds at the shipping-point and 11.7 pounds when they reached the terminal markets. Of the sample sacks, 56 percent were out of grade at the terminal market. The increase in defects was considerably higher in the cars shipped to Chicago than in the cars shipped to Des Moines. Total grade defects increased 8.6 pounds per 100 pounds in the Chicago shipments and 1.8 pounds per hundredweight in those shipped to Des Moines. Oregon studies conducted a year earlier show an 8.2-pound average increase in defects from eastern Oregon to Chicago. Not all of this increase may be regarded as transit damage. Some of the

damage was present at the shipping-point but was not detected or fully recognizable at the shipping-point inspection. In other words, there was some shipping point damage which was not detected until the terminal inspection. The additional shipping-point bruises recognized at the terminal market averaged 2 pounds in all samples of the Idaho - Oregon study, while the increase to individual markets averaged 3.2 pounds to Chicago and 0.3 pounds to Des Moines. Transit damage attributed an average of 2.7 pounds and damage in the Chicago samples was more than twice as high as in Des Moines samples. There were indications that part of the comparatively higher damage in the Chicago cars resulted from rough handling in the railroads yards or somewhere in the transit process. The average shift in the load of six Chicago cars was approximately 30 inches while the position of the load in the Des Moines cars was practically unchanged. All of the cars were loaded in the same manner; therefore, it is doubtful that the shifting resulted from loose loading or difference in loading method. The authors of the Idaho - Oregon study described the increase in defects as largely transit damage and shipping-point bruises. Soft rot increased 5.7 pounds per hundredweight in one of the test cars shipped from Oregon to Chicago in August, 1948. This was excessive compared to other early potato shipments. Soft rot usually results from bacteria entering potatoes with cuts, bruises, or broken skin. This bacterial activity is stimulated by favorable temperature conditions. It is possible that some of the defects classified as cuts and bruises in other studies could have easily developed soft-rot if bacteria were present and had time to operate under favorable temperature conditions.

Quality loss studies in the Idaho late-potato crop were conducted in January and February, 1950. Grade defects found at the terminal inspection averaged 10 pounds per hundredweight higher than they did at the shipping-point inspection. The shipping-point in this case was Idaho Falls, and the terminal markets were Des Moines and Indianapolis. Transit damage was credited with 2.1 pounds and air checks 1.6 pounds. The quantity of shipping-point mechanical damage detected at the terminal inspection which was present but unnoticed at the shipping-point inspection was 6.1 pounds. Some of the bruises or mechanical damage were present at the shipping-point but became visible only after the tubers affected dried out or turned dark. Other defects were minor and accounted for 0.2 pounds.

An Increase in Potato Damage is Not Confined Entirely to Type of Transportation and Distance from Market

This conclusion may be drawn by comparing the work of the western region with studies conducted by the Production and Marketing Administration in cooperation with the Agricultural Experiment Station and Department of Agriculture of New York. Examination of potatoes shipped the relatively short distance from Long

Island to New York and vicinity reveals that damage from cuts and bruises doubled from shipping point to the wholesale premises. Observations including 1482 samples representing 90 truck shipments disclosed that cuts and bruises increased from an average of 3.9 percent at shipping points to 7.5 percent at wholesale. Defects other than cuts and bruises did not change materially in marketing channels. Nonprogressive defects such as insect injury and wire-worm damage constituted 1.4 percent of all potatoes examined at shipping-point. These defects could have been removed in the grading operation. The studies in the western region of the United States also show that defects other than cuts and bruises do not change materially in the marketing channels.

Freight Car Floor Pads Reduce Transit Damage

All the test shipments from Oregon, Idaho, and Colorado emphasize that floor pads reduce transit damage. In the Idaho late-potato study, transit damage was 0.5 pounds per hundredweight less in the padded samples than it was in the unpadded samples. Pads reduced transit damage an average of 1 percent per 100-pound sack in the Idaho - Oregon early crop study. The 1948 Oregon quality study states that Chicago dealers frequently mentioned the desirability of using floor pads. Dealers emphasized that floor pads protect the potato bags exposed to the car floor. However, protection does not necessarily end at the floor layer, for some of the damage studies show less injury in the upper layers when pads are used.

In the 1949 Idaho - Oregon study conducted with early-crop potatoes, the transit damage was quite heavy among floor sacks when compared with center and side sacks. Floor pads reduced by 40 percent the average transit damage in the floor sacks alone. This amounted to almost 3 pounds less damaged potatoes per sack.

Weight Losses in the Marketing Process

Samples of the early-crop in the 1948 Oregon study indicate that sacks of potatoes weighing 103 pounds at shipping-point shrunk 2 or 2½ pounds by the time they were unloaded at Chicago. Sacks weighing less than 102 pounds at the shipping-point generally weighed less than 100 pounds on arrival at Chicago. Sample shipments of late-crop potatoes from Idaho to Des Moines in 1950 reveal an average weight loss of 1.4 pounds per hundredweight.

Many potato packs are classified in the sales transaction as 10-ounce minimum or 8-ounce minimum. The 10-ounce potatoes lost 2.2 pounds per hundredweight or approximately ¼ ounce for each 10 ounce tuber in the shipments from Idaho Falls to Des Moines and Indianapolis. Individual potatoes weighing 10 ounces or only slightly more at the shipping-point may shrink below the minimum weight classification in the terminal market. Thus packers and shippers must make allowances for shrinkage in size of

individual potatoes as well as total weight loss per sack if they want the potatoes to reach the destination according to specified classification in size and weight.

Although the 100-pound containers averaged more than 100 pounds at the terminal markets in the Idaho and Oregon studies, there was a significant variation in the weight. The late-potato study in Idaho shows that samples ranged from 94 to 108½ pounds at the shipping-point. In the terminal market, the same samples ranged from 93 to 106½ pounds. The proportion of underweight sacks was 17 percent at shipping-point, and this proportion increased to 33 percent at the terminal market. Of the 67 percent that weighed 100 pounds or more at the terminal market, 26 percent weighed between 100 and 102 pounds and 41 percent weighed over 102 pounds.

Early-crop studies in Oregon show that 41 percent of the bags labeled 100 pounds weighed less than 100 pounds when inspected in Chicago, 41 percent weighed 100 to 102 pounds and 17 percent weighed 102 pounds or more. Where it is customary to pay farmers according to the number of bags filled in grade, the farmer loses the quantity of overweight. On the other hand, loss due to underweight may be assumed by the retailer, passed on to the customer in higher mark-ups or passed backward to the shipper in the form of lower prices offered.

Quality of Potatoes in Retail Stores

In the samples of the early Idaho - Oregon potatoes inspected in Chicago retail stores in 1949, 44 percent of the potatoes offered at retail had injury and defects; 23 percent were classified as defective enough to count against grade; and 21 percent were classified as injury not serious enough to count against grade. The most important defects were bruised, broken, or cut potatoes.

Retail samples in the Idaho late-potato study in Des Moines contained an average of 65 percent injury and defects, of which 43 percent were defects that count against U.S. No. 1 grade, and 23 percent were classified as injury not serious enough to count against grade. Only one-third of the potatoes in retail samples were free of injury and grade defects. Of the defects, 95 percent were mechanical damage and air checks.

The inferior condition of potatoes at retail stores is not confined to one or two cities. Data taken from publications of the experiment stations of Maine, New York, and Pennsylvania, reveal that four-fifths of the potatoes in New York city, three-fourths in Philadelphia, and two-fifths in Boston and Maine markets failed to meet requirements of the claimed U.S. No. 1 grade.

Potato quality research shows that poor quality and condition is largely induced by rough and careless handling from the farm to retail store. The total damage is not the result of one phase

in the movement to market but the sum of all activities. Some investigations reveal that more than half of the total defects are present when the potatoes leave the shipping-point. Practically all of the quality studies conducted so far show that, on the average, the federal grade's maximum tolerance of 6 pounds per hundred-weight is usually present when the potatoes leave the shipping-point. Most conclusions show that transit damage is only a minor part of the total defects found at the retail level. The extent to which one particular handler contributes to inferior quality may not be large, but the cumulative damage that occurs through the marketing channel results in serious reduction in salability. The poor condition of potatoes in the retail markets is certainly a challenge for positive action in quality improvement. Research indicates that no single group in the production and marketing activity can indict the others for the entire damage at the retail level. There is a certain amount of quality improvement necessary at every phase in the production and marketing process. After potatoes have been injured, in harvesting or during subsequent handling, great difficulty is encountered in detecting and removing the injured tubers, and many of them unavoidably will go all the way through the marketing channel to the consumer. The most effective way to improve quality at the consumer level will be to reduce the injury to individual tubers through all stages of handling and distribution. Immediate requests of potato growers may conflict with consumers' acceptance and consumption. The immediate request of potato growers is a high grade-out while consumers want to buy potatoes free of injury and damage. This conflict of interests could easily be a compromise between selling some defective tubers and having consumers reduce their per capita consumption.

Methods to Improve Quality

Reduce Mechanical Damage at Harvest Time

Methods that will reduce mechanical damage to potatoes at harvest time are outlined in bulletin number 278 published by the University of Idaho Experiment station. It is obvious that mechanical damage begins at the digger blade where potatoes are cut by the digger point or bruised against the surface clods. A three-year study by P.M.A. and Colorado Agricultural Experiment Station based on stored potatoes shows that each year, 1948, 1949, and 1950, 25 to 30 percent of the potatoes graded U.S. No. 2 were placed in that grade because of bruises during harvest. The author of the Idaho bulletin outlines some simple methods that achieve accurate control of the depth at which the digger point operates. Operators are urged to use the press wheel to control depth of digging and to pulverize some of the surface clods. Removal of this wheel to reduce weight has probably led to an increase in sliced

potatoes and culls. This is evident in rough fields where machines are mounted on the tractor drawbar.

Bulletin 278 outlines 12 suggestions and a number of other valuable recommendations that will help reduce mechanical injury :

1. Reduce the field speed of the digger to $1\frac{1}{2}$ miles per hour.
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 $\frac{1}{2}$ to $\frac{3}{4}$ inches thick. Cement rubber 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.
9. Reduce the speed of any transfer or elevator chains 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.

Some bruised and damaged potatoes pass on to the shipper, common carrier, wholesaler, retailer, and consumer, deteriorating at each stage. This creates claims and adjustments between seller and buyer and increases the cost of marketing potatoes. Although the farmer does not pay the marketing cost directly, there is a good indication that he pays it indirectly, for the farm price in the long-run bears a close relationship to what consumers pay minus the cost of marketing services. Farmers have a direct financial interest in the marketing structure and the final product offered to consumers.

If defective potatoes average around 6 pounds per 100 pounds at the shipping point after they have been graded, this should indicate that it would be extremely difficult to market potatoes at the retail level in grade. Do growers insist on maximum grade-out tolerated in federal grades? Can the competition be so keen that packers must allow the maximum tolerance allowed by federal inspection to pass the grading table? Is the cost of removing all potatoes that count against grade so high that it is not practical? Quality studies did not answer these vital questions. It may be contended that grades are devised to facilitate selling and that consumer protection is a secondary consideration. Perhaps it is physically impossible and impractical to remove more defective potatoes at the grading table. It is difficult to justify poor grading on a

cost basis because the extra cost of removing practically all defective potatoes is a relatively insignificant part of the total retail price of potatoes. Another item that would nullify the cost argument is that a majority of consumers evaluate quality as the most important item when they buy potatoes. Price holds a poor third place in the estimation of most consumers.

Even if the potato trade used a container that assured perfect protection against transit damage, and if there were no further damage beyond the shipping-point, the quality research conducted thus far shows that more than half of the packages marketed will reach the retail level out of grade. This suggests that some additional merchandising is necessary at the retail level if the potato industry wants potatoes to reach the consumer in grade.

Growers of late potatoes should try to achieve more maturity in their crop. Mature potatoes have a better appearance in the market and are less susceptible to bruises and decay. Immature potatoes marketed early in the season are more perishable and subject to more skinning than mature potatoes. Skinned areas may not be unattractive in the early stages of marketing but are discolored and unattractive by the time the potato reaches the retailer. Skinned areas also permit organisms to enter the potatoes that cause soft rot and decay, especially in the seasons when the temperature is high. Farmers may encourage maturity in their crop by use of vine killers or chemicals. This has some possibilities for improving the appearance of the tubers.

Methods for Improving Quality at Packing Plants and Maintaining it in Shipping

1. Use rubber belts and rubber-covered equipment in all operations where it is possible.
2. Remove all drops. If this is impossible, cushion the drop with pads or soft material.
3. Cull defective and damaged potatoes.
4. Weigh and sew the containers carefully.
5. Use floor pads in freight car or truck.
6. Load the common carrier in a manner that will minimize shifting of the load in transit.
7. Hire personnel that handle the potatoes carefully. Insist on proper handling and keep employees quality conscious.
8. Pack potatoes in a type of container that minimizes damage.
9. Try to avoid unsold rolling cars. Sometimes they are subjected to extra abuse, travel, delay, and congestion in reaching a satisfactory market.

Maintaining Quality in Transit

1. Expedite shipments as much as possible.

2. Provide protection against high and low temperatures.
3. Encourage smooth operation of cars in transit.

Maintaining Quality at Wholesale and Retail

1. Caution all personnel to handle potatoes with care; eliminate rough handling.
2. Avoid exposure to strong light and light exposure for long periods of time. Greening destroys potato appearance and quality.
3. Purchase potatoes in the type of container that minimizes damage.

All growers and handlers have a joint responsibility in providing the kind of potatoes consumers want if they want to hold a strategic position in the bid for consumers' dollars. Competition between different commodities for a place in the consumer's food basket has intensified in the last several decades with increasing emphasis on services, variety, and merchandising.

Consumer Preference

A Majority of Housewives Prefer Potatoes Uniform in Size If Prices of Uniform Sizes and Mixed Sizes Are Equal

Approximately three-fourths of the consumers included in the Los Angeles, Cincinnati, and Kansas City studies preferred Russet Burbank potatoes graded according to uniform sizes. Some housewives prefer mixed sized potatoes even when uniform sizes are available at the same price according to investigations conducted in 1948 and 1949. Sized Russet Burbank potatoes were divided into three classes: small - 2 inches minimum diameter to 7 ounces, medium - 7 to 10 ounces, and large - 10 to 13 ounces. Packages containing mixed sizes included potatoes with a 2-inch minimum diameter and larger. Prices were equal for all packages containing a similar quantity of potatoes. This was necessary to eliminate the possible influence of price on consumers' choice. Table 1 shows the consumer preference for sized and mixed potatoes when prices are equal for all packages. Assorted sizes represented 17 to 27 percent of the purchases in the cities where the studies were conducted. One-fourth of the purchases were small potatoes even though large potatoes could be purchased at identical prices. Approximately one-third of the sales were medium size potatoes, while 20 to 24 percent were large potatoes.

TABLE 1

Consumer Preference for Sized and Unsized Russet Burbank Potatoes at Uniform Prices in Three Cities, 1948 - 1949

| Tuber Size Group | Sales in Selected Retail Chain Stores | | |
|---------------------------|---------------------------------------|----------------|----------------|
| | Los Angeles | Cincinnati | Kansas City |
| Sized | Percent | Percent | Percent |
| Small (2 inches to 7 oz.) | 23 | 28 | 25 |
| Medium (7 oz. to 10 oz.) | 30 | 30 | 34 |
| Large (10 oz. to 13 oz.) | 20 | 21 | 24 |
| Total sized | 73 | 79 | 83 |
| Not Sized | | | |
| 2 inches and up | 27 | 21 | 17 |
| Total | 100 | 100 | 100 |

Colorado studies in the Denver market with round potatoes in 1948 showed that 80 percent of the consumers preferred potatoes uniform in size.

More Than Two-fifths of the Housewives Chose Medium Potatoes When Mixed Sizes Were Not Available

When the only available potatoes were of uniform sizes, 41 to 48 percent of the consumers selected the medium size, 30 to 35 percent the small size and 27 to 29 percent chose the large size in Los Angeles, Cincinnati, and Kansas City. Where two different sizes of round potatoes were offered in Denver, 60 percent of the consumers preferred medium potatoes while 40 percent preferred the small size. Studies in all of the cities showed a definite desire for medium sized potatoes although the degree of preference varied slightly in different markets. Small potatoes were second in order of preference and large ones were third.

Consumers' Preference for Sized Commercial Packages Declines When the Extra Cost for Sorting and Packages Are Added to the Selling Price

The proportion of 10-pound packages sold declined 11 percent when the selling price was increased to cover the cost of mesh bags and extra labor, according to the 1948 consumer survey in Denver. Before price differentials were established, 58 percent of the total purchases were chosen from small commercial packs of potatoes and 42 percent were chosen from bulk displays. After the cost of mesh bags and labor were added, only 47 percent of the purchases

were prepacks, while bulk sales increased to 53 percent of the total volume sold. Less than half of the consumers selected packaged potatoes when packaged and bulk displays were equally available at prices representing differences in cost. The results reached in this study correspond favorably to the housewives' statements of preferences published in "Potato Preferences Among Household Consumers" prepared by the Bureau of Agricultural Economics in 1948. According to the report, more city homemakers prefer loose potatoes than packaged ones. The specialized service of pre-packaging potatoes in small containers appeared to be limited to less than half of the total volume sold at the time of the study.

Greater Preference for Open Mesh Bags Than for Paper Window Bags Among the Minority Who Desire Packaged Potatoes

When the choice was between open mesh and paper window bags, 70 percent of the housewives preferred the 10-pound open mesh bag, according to the Denver interviews. The reason for this choice was the buyers' desire to see the potatoes they were buying. This study and others reveal that some housewives distrust the quality of potatoes packed in containers they cannot easily examine.

Price Differentials Create a Substantial Shift in Consumers' Preference for Size

Progressive increases in the price of medium and large potatoes in Los Angeles in 1948 were followed by shifts in purchases to the small and mixed potatoes when the price of the small and assorted sizes remained fixed. Shifts in purchases from the medium to the small and assorted sizes were more common than the shifts from the large to small and assorted sizes. Similar results were obtained in corresponding studies in Cincinnati and Kansas City. Preference for the larger sizes was more tenacious in the presence of price changes than the preference for medium potatoes. Apparently more of the larger potatoes are wanted for the specific purpose of baking. Price differentials ranging from one-half cent to one and one-half cents per pound or from 50 cents to \$1.50 per hundredweight between the small potatoes and other sizes brought about a substantial shift to the small size potatoes.

Price differential investigations emphasize a point or arrangement of prices that brings the greatest returns to growers and packers. These same price differentials may be employed to change consumers' preferences in relation to size of potatoes and type of containers purchased. But the studies in this summary do not point out the price differences that will induce these conditions. Perhaps this may be regarded as an asset rather than a detriment. One set of price differentials that achieves the maximum returns and distribution for a particular time may also be misleading if extended to other markets and other time periods. The composition of production and consumer preferences are not fixed factors. Because

of this, members of the potato trade strive to achieve the desirable differentials in daily market transactions, making price differentials subject to continuous change.

This work does point to certain limitations in marketing services such as the following:

1. Retail stores do not have sufficient space to display many different sizes of a product with an exceedingly low unit price such as potatoes. Very few stores could provide space for each variety and state of origin of three or four sizes in three or more different types of containers. This limitation would undoubtedly create considerable resistance in certain segments of the trade.
2. Sorting by sizes and packaging increases the cost of marketing and retail price of the product. Limitations for these services exist even when they are provided gratis. There is an inverse relationship between the progressive cost of additional services and consumers' preference for these services. This was borne out in the studies conducted by Idaho and Colorado experiment stations.

There is a significant number of consumers in most potato markets who prefer uniform-sized packaged potatoes and are willing to pay the additional cost of these services. Many shippers and packers provide the facilities necessary and perform these services when it pays. It has become necessary for competing production areas to consider the significance of consumer preference in order to obtain a maximum volume of sales.

Cooking Quality and Specific-Gravity Grading

According to the potato preference publications prepared by the Bureau of Agricultural Economics in 1948, homemakers like their all-purpose potato to cook-up mealy, even, and soft without falling apart. A few attempts have been made to design or achieve a method of grading that will separate potatoes according to their cooking quality. Much emphasis in recent years has been placed on the relationship between composition and the specific gravity of potatoes. Some research workers have compiled data showing the relationship of specific gravity to the dry matter content.

Kunkel wrote a brief summary of the Colorado tests of consumer reaction to specific-gravity graded potatoes in the American Potato Journal February, 1950. The first study was limited. But the results showed that 89 percent of the customers favored potatoes graded as to their cooking qualities and 61 percent stated they would use more if the cooking qualities of potatoes were guaranteed.

A second test of consumer acceptance of specific-gravity graded potatoes was conducted in Fort Collins and Loveland, Colorado, in 1948 - 1949. Results at Fort Collins indicate that a fairly satisfactory separation of potatoes into cooking quality grades, such as baking and boiling, had been made by the grader when measured by the response of the purchasers. Of the consumers who purchased baking potatoes, 71 percent rated them as excellent for baking, whereas, only 31 percent of those who used boiling potatoes for baking rated boiling potatoes excellent for baking. Only 39 percent of those who boiled baking potatoes rated them excellent for boiling. Of those who boiled boiling potatoes, 70 percent rated them excellent for boiling.

It appears that specific-gravity grading is possible and there are preferences for mealiness in potatoes. The institutional trade, potato chip industry, and other processors are interested in grades for potatoes that specify total solids or specific gravity. The Research and Marketing Act Potato Advisory Committee recommended in 1951 that work should be initiated to develop special grades for potatoes that specify total solids content or specific gravity.

Quality, Size and Defects In Potato Crops

Quality and size of potatoes play a major role in prices and income of growers and dealers. The quantity of defects and proportions of different sizes of potatoes can make the difference between profit and loss. Dealers like to handle high-quality potatoes. Handling such tubers costs less than it does to handle poor quality potatoes. It takes more time to grade inferior potatoes. Consumers are willing to pay more for high quality and larger size potatoes, and these price differentials are reflected in the growers' prices. Market reports of growers prices usually show two outstanding differentials - one for grade and one for size. These differentials are illustrated from a daily quotation for Russet Burbank potatoes in February, 1951 and are inserted for illustrative purposes only. These prices are not necessarily typical of any longer period of time than a day.

Growers' Prices Per Hundredweight

| Grade | Small | Medium | Large |
|------------|--------|--------|--------|
| U.S. No. 1 | \$1.00 | \$1.15 | \$1.25 |
| U.S. No. 2 | .35 | | |
| Culls | .15 | | |

Price Differentials Per Hundredweight Between the Above Grades and Sizes

| Grade Differential Between | (cents) | Size Differential Between | (cents) |
|-------------------------------|---------|------------------------------|---------|
| U.S. No. 1 - U.S. No. 2 | 65 | Small - medium | 15 |
| U.S. No. 2 - Culls | 20 | Medium - large | 10 |
| U.S. No. 1 - Culls | 85 | Small - large | 25 |

These data show that the price difference between grades U.S. No. 1 and U.S. No. 2 is 65 cents per 100 pounds; U.S. No. 2 and Culls, 20 cents; and the total difference between No. 1's and culls is 85 cents per 100 pounds. This represents a loss in income when 100 pounds of No. 1 potatoes are reduced to culls. Under February 1951 market conditions, the growers' price differential between small and large potatoes ranged from 15 to 25 cents. It is obvious that potato producers might increase their income by growing a larger proportion of medium and large potatoes if these price differentials prevail. Some possibilities for improving growers' income may be found in reducing damage and injury which lowers the grade of tubers.

Price differentials vary with time in response to the immediate supply and demand, along with such factors beyond immediate supply and demand as government programs, marketing orders, cost of handling, degree of competition, and desires of consumers. Although the differentials vary, the premium paid for No. 1 medium and large potatoes has been high enough to provide incentives to produce potatoes of this size and quality. Farmers and state experiment stations have and still are working cooperatively to produce potatoes of a size and quality that will yield the highest income.

The quality and appraisal of defects found in crops suggest areas for improvement which may possibly enhance potato income. Size classification shows the relative quantities of the various sizes produced and helps to explain the size-price differential.

Size has become increasingly important in potato production in recent years. Surplus production has intensified the interest in marketing orders which usually contain size restrictions. Restrictions tended to move from the smaller to the larger potatoes when surpluses became a problem. One of the major problems for administrators of marketing orders is knowing what proportion of the crop the order will eliminate. Determining whom the order will affect most is another question receiving inadequate attention. Farmers in some producing areas grow a larger proportion of small potatoes than in other areas.

Relative Importance of Grade Defects

In 1948 a cooperative study was undertaken by Colorado and Idaho Agricultural Experiment Stations, Federal-State Inspection Service and the Production and Marketing Administration of the U.S.D.A. to determine the defects, quality and size of potatoes in the 1948 crop.

The relative crop proportions in each grade classification is shown in Table 2. Data for the ninth crop-reporting district represents the area in the upper Snake River valley commonly known as the Idaho Falls district. The eighth crop-reporting district is the area commonly known as the Twin Falls area. Weighted average distribution of grades for the two areas is shown on the bottom line.

TABLE 2

Grade Quality of the 1948 Idaho Late Potato Crop
Taken From 140,000 bushels and 273 growers' lots

| Crop-Reporting District | Proportion of Tubers in Each Grade | | | |
|--------------------------|------------------------------------|----------------------|------------|---------|
| | U.S. No 1 2" Minimum | U.S. No. 1 Size B | U.S. No. 2 | Culls |
| | Percent | Percent | Percent | Percent |
| | | | | |
| 9 (Idaho Falls District) | 69 | 11 | 13 | 9 |
| 8 (Twin Falls District) | 67 | 8 | 15 | 10 |
| Weighted Average | 68 | 9 | 14 | 9 |

The marketing agreement for the 1948 crop prohibited out-of-state shipment of potatoes less than 2 inches in diameter. This restricted the sale of B's. When B's and culls are combined, the proportion of the crop eliminated from out-of-state shipment is raised to 18 percent. If No. 2's were restricted from shipment as they were during part of the 1950-51 season, interstate sales would have been limited to 68 percent of the crop, and 32 percent of the crop would have been eliminated from interstate trade. As far as out-of-state sales are concerned, culls would have amounted to almost one-third of the entire crop.

A classification of the reasons for grading potatoes as U.S. No. 2 was made by the Production and Marketing Administration in cooperation with the Colorado Agricultural Experiment Station based on the 1949 and 1950 crops. Bruises and growth defects were the most important causes for the No. 2 classification. Bruises and growth defects were responsible for 53 percent of the Red McClure No. 2 classification and 62 percent of the Bliss Triumph No. 2 classification.

Knobs, mechanical injury, bottlenecks, and growth cracks shown in Table 3 were responsible for more than 70 percent of the defects that lowered the grade from No. 1 to No. 2 in the 1948 Idaho late potato crop.

Malformed tubers were the most important single group of defects among the No. 2 potatoes. Improvement of production practices or cultural patterns will reduce deformities such as knobs and bottlenecks. It is significant that approximately one-fifth of the defects in No. 2's was mechanical injury. Most of the mechanical injury could be averted by improving the harvesting and handling technique. This would shift a substantial quantity of potatoes from No. 2's to No. 1's and from culls to 2's and 1's.

TABLE 3

Nature and Importance of Grade Defects Among U.S. No. 2's and Cull
in the Idaho Late Potato Crop, 1948

| Defect | Grade | | | | | |
|------------------------------|----------------------------|---------------------------|---------------------|-----------------|-----------------|---------------------|
| | U.S. No. 2's | | | Culls | | |
| | Idaho Falls District | Twin Falls District | Weighted Average | 9th District | 8th District | Weighted Average |
| | percent | percent | percent | percent | percent | percent |
| Knobs | 23 | 17 | 21 | 7 | 6 | 7 |
| Mechanical injury | 20 | 17 | 19 | 10 | 12 | 11 |
| Bottlenecks | 15 | 20 | 17 | 4 | 6 | 5 |
| Growth cracks | 16 | 12 | 14 | 4 | 2 | 3 |
| Misshapen | 6 | 15 | 10 | | | |
| Stem end discoloration | 4 | 9 | 6 | 1 | 3 | 2 |
| Wireworm | 6 | 2 | 4 | 1 | 1* | 1* |
| Dry rot | 3 | 5 | 4 | 1* | 1* | 1* |
| Soft rot or wet breakdown | 3 | 3 | 3 | 7 | 10 | 8 |
| Scab | 3 | 1* | 2 | 1 | 1* | 1* |
| Size | | | | 55 | 49 | 52 |
| Sunburn | | | | 10 | 12 | 11 |

1* Less than 1/2 of 1 percent.

Size was the most important factor for culls. Of the culls, 52 percent were classified too small for commercial grades. Mechanical injury and sunburn were equally important, as 11 percent of the defects in culls were mechanical injury and 11 percent were sunburn.

Tuber Size of Commercial Grades In the 1948 Potato Crop

Potato growers, dealers and policy administrators could make wiser decisions and operate with more confidence as far as reasonable prices are concerned if they had access to reliable information showing the distribution of tuber size in each potato crop. The supply of different sizes is important in establishing both producers and consumers price differentials. Size information reveals the quantity or portion of a crop restricted from commercial channels by grade laws and marketing orders. Size information is necessary for the particular period or crop involved in current decisions because proportions of the various tuber sizes as well as

supply, prices, and potato problems change from one year to the next. In order to achieve maximum use from this type of information, it should be current and continuous. Unfortunately, the tuber size information has not been recorded in this manner.

Table 4 shows the size distribution in the 1948 Idaho late-potato crop. This data was originally collected for the consumers study to show how the proportion of tuber sizes produced compare with the proportions desired by consumers.

TABLE 4

Tuber Size Among U.S. No. 1's in 1948 Idaho Late Crop

| | Proportion of Tubers in Each Size Group | | | | |
|------------------|---|---------------------|-------------------------|--------------------------|------------------|
| | 1½" & up to 2" | 2" & up to 7 oz. | 7 oz. & up to 10 oz. | 10 oz. & up to 13 oz. | 13 oz. & over |
| | percent | percent | percent | percent | percent |
| Idaho Falls | 12 | 37 | 25 | 14 | 12 |
| Twin Falls | 11 | 34 | 24 | 15 | 15 |
| Weighted Average | 12 | 36 | 25 | 14 | 13 |

Of the 1948 crop, 48 percent were classified below 7 ounces. The proportion between 7 - 13 ounces was 39 percent of the No. 1 grade while 13 percent were 13 ounces or more.

If the potatoes below a 2-inch minimum are eliminated from marketing channels, as they were in recent years, the relative importance of each size changes as shown in the data of Table 5. Potatoes in No. 1 grade below 7 ounces account for 41 percent; 7 - 13 ounce, 45 percent; and 13 ounce and over, 14 percent of the total quantity graded as No. 1's.

TABLE 5

Tuber Size Among U.S. No. 1's, 2-inch Minimum

| District | Proportion of Tubers in Each Size Group | | | |
|------------------|---|-------------------------|--------------------------|------------------|
| | 2" & up to 7 oz. | 7 oz. & up to 10 oz. | 10 oz. & up to 13 oz. | 13 oz. & over |
| | percent | percent | percent | percent |
| Idaho Falls | 42 | 29 | 16 | 13 |
| Twin Falls | 38 | 29 | 16 | 17 |
| Weighted Average | 41 | 29 | 16 | 14 |

Approximately 30 percent of the tubers were classified as 10 ounces or more when potatoes below 2-inch minimum were eliminated. Average size of potatoes in the Idaho Falls area was slightly smaller than in the Twin Falls area.

TABLE 6
Tuber Size in Colorado U.S. No. 1 Potatoes, 1948-1950

| Crop Year | Variety | Below 2¼" | 2¼" to 2¾" | 2¾" to 3½" | Over 3½" |
|------------------|-----------------|----------------------|-----------------------|-----------------------|-----------------|
| 1948 | Red McClure | 16 | 43 | 35 | 6 |
| | Other Varieties | 12 | 35 | 44 | 9 |
| 1949 | Red McClure | 13 | 41 | 37 | 9 |
| | Bliss Triumph | 12 | 31 | 49 | 8 |
| 1950 | Red McClure | 12 | 45 | 34 | 9 |
| | Bliss Triumph | 9 | 28 | 42 | 21 |

* Bliss Triumph, Cobbler, Rural and Russet Rural.

When all the round potatoes between 2¼ and 3½ inches are classified as medium potatoes, it is obvious that more than three-fourths of all commercial grades fall in this class. Actually, round potatoes above 3 inches in diameter should be classified as large as far as consumer grades are concerned. Even if round potatoes are classified according to consumer grades they contain a larger proportion of medium potatoes than Russet Burbanks. The Idaho crop of Russet Burbanks usually contains a larger proportion of small and large potatoes, but a smaller proportion of medium potatoes, than corresponding crops of round potatoes. This helps to create wider price differentials for size in Russet Burbanks than in round potatoes. Producers of Russet Burbank potatoes could increase their income if a greater proportion of the crop were medium and large potatoes.

Bibliography

The following seven Western Regional Articles and Publications were prepared while the Western Regional Potato Marketing Project was in progress.

1. Davis, George B. *Quality Loss in Marketing Oregon Early Crop Potatoes*, Oregon Agricultural Experiment Station Bulletin 468, 1949.
2. Eberhard, M., Davis, C., Davis, G., Korzan, G. *Significance of Quality Loss in Marketing Early Idaho-Oregon Potatoes*, Oregon State College Agricultural Experiment Station Bulletin 495, 1951.
3. Davis, Clifford L., and Wilcox, Robert W. "Quality Loss in Trial Shipments of Idaho Late-Crop Potatoes," *The Marketing and Transportation Situation*, Bureau of Agricultural Economics, U.S.D.A., March 1951.
4. Eberhard, Milton F., and Eke, Paul A. *Consumer Preference for Sized Idaho Russet Burbank Potatoes*, Idaho Agricultural Experiment Station Bulletin 282, 1951.
5. Eberhard, Milton F., "Defects, Quality, and Size of Potatoes in 1948," Idaho Agricultural Experiment Station. (Unpublished), 1949.
6. Humphrey, Elmer. *Steps that Can Be Taken to Reduce Mechanical Damage to Potatoes at Harvest Time*, Idaho Agricultural Experiment Station Bulletin 278, 1950.
7. Kunkel, R. "Gravity Grading Potatoes," *American Potato Journal*, Vol. 27, Number 2, February, 1950.

OTHER LITERATURE CITED

1. *Potato Preferences Among Household Consumers*. U.S.D.A., Misc. Publ. No. 667, Washington, D. C., 1948.
2. Kelley, Wenner, Krantz, and others. *Relationship of Price and Quality of Potatoes at Retail Level*. Minnesota Agricultural Experiment Station Bulletin 306. North Central Regional Publication, Number 16, 1950.
3. McGaha, Malvin E. "Potatoes Aren't Hardware," *Marketing Activities*, U.S.D.A., P.M.A., October, 1950.
4. Merchant and Woodward, *Quality of Potatoes in Retail Stores in Boston, Massachusetts and Maine Markets*, 1948, Maine Agricultural Experiment Station Bulletin 466, 1949.