UNIVERSITY OF IDAHO
College of Agriculture

Shipping Idaho Potatoes In 50-Pound Boxes

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IDAHO Agricultural Experiment Station

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What Was Done

THIRTY-SIX different types of 50-pound potato cartons were designed and tested. The boxes were filled with selected potatoes, loaded in pre-arranged places in railroad cars, and shipped from Idaho to Pennsylvania. The potatoes in each box were graded for bruising upon arrival to find whether fluting-type, weight of fiberboard, and ventilation type of the boxes, when considered in relation to layer of the box in the car, had any effect on bruising. Each of the 36 box types was tested in the three bottom layers in each car end. Three cars were shipped, each car end being a separate replication.

Summary of Results

• When potatoes are shipped in fiberboard boxes, it is possible to ship more than 520 cwt. of potatoes in a car with minimum bruising. This is 40 percent more than is now shipped in sacks.

• No bruising damage differences are apparent to boxed potatoes among the bottom three layers in a car filled seven layers high. Potatoes in the bottom layer had no more bruises than the other layers.

• Ventilation is satisfactory in boxed potatoes, if boxes are not wedged too tightly in the car. Loading methods are much more important to ventilation than ventilation features of the box itself.

• No one ventilation - type box was better at protecting the potatoes from bruises than the others tested.

• Certain types of fiberboard protect potatoes better than others. Tests show "B" type flute superior to "A" flute.

• Boxes made from 200-pound board were just as good or superior to boxes made from 250-pound board. Since the lighter fiber board is less expensive (boxes will cost 3 to 4 cents less per cwt. of potatoes), boxes of 200-pound strength are recommended.

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Shipping Idaho Potatoes in 50-Pound Boxes

KERMIT BIRD*

IDAHO POTATOES are shipped great distances to market. A primary problem in shipping is the damage suffered by the potatoes bouncing over hundreds or thousands of miles. Bruises come not only from bouncing and shifting of loads, but also from the weight of potatoes piled on top of each other—the top potatoes squeezing those lower in the car. Bruising is such a factor that freight rates take the number of potatoes per railroad car into consideration, and, in effect, set an upper limit of 36,000 or 40,000 pounds per car to minimize bruising.

The questions in shipping Idaho potatoes, then, are:

Can some container other than burlap compete on a cost basis?

Would the saving in bruising be great enough to offset the higher container price?

In considering cost of a potato shipping container, not only is the cost of the container itself to be considered, but also the costs involved in filling and handling the container (handling in the packing shed, in transport, in warehouses and in the retail outlet), and transportation rates if affected by the container.

This study investigated bruising damage involved in shipping Idaho potatoes in 50-pound cardboard boxes of various strengths. Even though the cost of two 50-pound cartons is greater than that of a 100-pound burlap bag, the possibilities of other types of savings by shipping in cardboard were investigated. Particularly was this study carried on with an eye to lessening bruising because of the box. Better bruise protection from the box would enable larger loads to be shipped per car and lower freight rates for boxed potatoes should follow. End result could be a larger market for Idaho potatoes, with increased benefits to producers, packers and consumers.

Procedure

The objectives of this study were (1) to find whether packing potatoes in fiberboard boxes enables shipping of larger loads per refrigerator car, and (2) to find what type box offers best protection to potatoes when shipped in large loads. Present loads contain 360 or 400 cwt. per car. The test loads of boxed potatoes were over 500 cwt. per refrigerator car.

Thirty-six different box designs were tested. Each of these 36 boxes was tested on the bottom layer, on the next-to-bottom layer, and on the third-from-bottom layer. The cars were loaded

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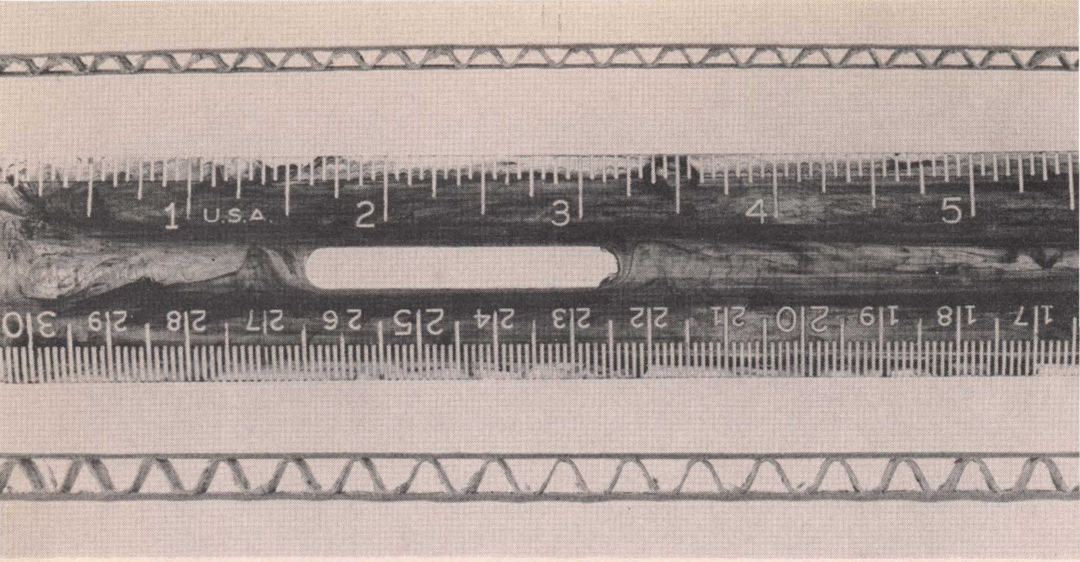

Figure 1—Cross sections of "A" flute top and "B" flute bottom. "A" flute has greater vertical strength, less horizontal protection.

seven layers high, the remaining four top layers of boxes being control boxes. The test boxes were in the ends of the cars, so the centers were also filled with control boxes of potatoes. Three cars of boxed potatoes were shipped and each end of the three cars contained a complete group of the test boxes to determine if there was any difference in bruising caused by being to one end of the car or the other.

Test box designs differed with respect to three factors: fluting, weight of fiberboard, and type of ventilation. Two types of fluting, "A" and "B", were tested. (See Figure 1) Two board weights, 200 pound and 250 pound, were used in making the experimental boxes. Nine ventilation types were used. Thus the experiment consisted in finding whether any of the 36 different boxes was better than the others, and also to find the effects of fluting, board weight, and ventilation type at each of the three bottom layers.

Car Loading

Each end of the three cars contained 108 test boxes, 36 box designs located in three bottom layers. Loading of the test boxes was as follows: Each test box was labeled according to its fluting, board weight, ventilation type, layer, and car end. Boxes of the same design were loaded layerwise, one immediately above the other. In other words, within one vertical column of boxes the bottom three layers consisted of three test boxes of the same design, and the top four layers were control boxes. The six car ends differed with respect to each other in the way the boxes were located horizontally. This pattern, similar to a Latin square, was used to randomize the position of each box design to eliminate effects of row and column. (See Appendix Table 2 for a complete description of horizontal location of boxes within the six car ends.)

The first car was loaded with boxes placed lengthwise in the car, except for the doorway where they were loaded crosswise.

Figure 2

Figure 3

This car contained 994 boxes. The second and third cars were loaded with one column lengthwise, one column crosswise, etc. This latter loading method was more efficient spacewise, allowing 1050 boxes to be loaded per car.

Figure 4

Inside dimensions of the cars used for the test shipments were $33'\ 2\frac{3}{4}''$ long and $8'\ 3''$ wide. The car height of $7'\ 3''$ allowed about 18 inches of air space above the top layer of boxes.

Potatoes shipped were Early Russets. The first car was shipped September 4, 1958. The second and third cars were shipped September 8 and 9. All three cars were half-stage iced. Cars were six days en route, arriving in Pittsburgh on the morning of the seventh day.

Design of Boxes

All boxes were two-piece, half-slotted, full telescope. Joints were glued; tops and bottoms were stapled with 12 staples on the bottom and 8 staples on the top. Waterproof adhesive was used in construction of all boxes. Each box held 50 pounds of potatoes.

Half the test boxes were of 200-pound bursting strength, paper weight being 42-33-42. The other half were of 250-pound strength, paper weight of 69-33-42.

One-half the test boxes were of "A" flute board and one-half were of "B" flute. Inside dimensions of the two boxes were $17\frac{1}{8}''$ x $13''$ x $9\frac{1}{2}''$. Outside dimensions of the "A" flute box were $17\frac{7}{8}''$ x $13\frac{3}{4}''$ x $9\frac{7}{8}''$. "B" flute, being slightly thinner board, had outside dimensions $17\frac{5}{8}''$ x $13\frac{1}{2}''$ x $9\frac{3}{4}''$.

"A" fluting board has 36 flutes per lineal foot and the flute height is 3/16". "B" fluting board has 52 flutes per foot and the flute height is $\frac{1}{8}''$. Characteristically, "A" flute provides greatest strength in the depth direction. It has less flat crush strength

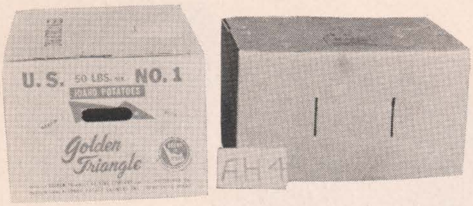

Figure 5

Figure 6

Figure 7

though than "B" board. Boxes made from "B" fluting board have less vertical strength and greater lateral and puncture strength than "A" flute boxes. See Figure 1 for an illustration of these two flute types.

There were nine ventilation types of boxes as follows:

1. Two ¼″ x 3″ vent slots on each side panel, and one ¼″ x 3″ vent slots centered in each end panel. (See Figure 2)

2. One ½″ x 1½″ vent hole centered at top flap score at each end. Also one ½″ x 1½″ vent centered in length adjacent to top flap score in each top flap. (See Figure 3)

3. One 1″ x 3½″ hand hole in each end. (See Figure 4)

4. Hand hole as above plus two ¼″ x 3″ vent slots through each side panel. (See Figure 5)

5. Two 1″ circular vent holes in each end. (See Figure 6)

6. Two ½″ x 1½″ vertical slots in each end panel. (See Figure 7)

7. No vent holes of any kind, printed. (See Figure 8)

8. No vent holes of any kind, no printing. (See Figure 9)

9. Hand holes in each end, plus top flap gap. (See Figure 10)

In summarizing this section on design of boxes, there were 648 test boxes, 324 "A" flute and 324 "B" flute, 324 heavy-board boxes and 324 light-board boxes. There were 72 boxes of each of the nine ventilation types. Within a car end each of the three layers contained the 36 test boxes so all three layers had 108 test boxes. The test was repeated six times, in each of the six car ends; the total boxes tested were 648.

Grading Methods

The method of determining whether one type box was superior to another was the protection offered by the box to the potatoes. The test of the box consisted of grading the potatoes for bruises after the potatoes had been shipped. Since potatoes within each car were from the same lot and the same truck load, potatoes within a car end were the same before shipping. Dif-

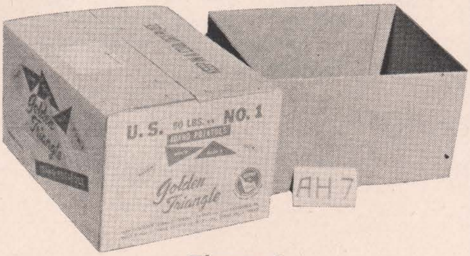

Figure 8

Figure 9

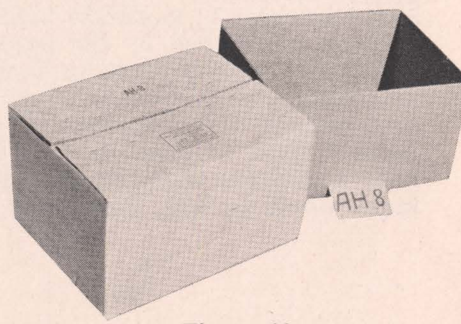

Figure 10

ferences in bruises to potatoes within a car end, then, are the result of using different boxes.

In the bruise determination test, each test box was opened and potatoes examined. For each box, potatoes were sorted into three groups according to damage; potatoes with slight or no bruises; potatoes with moderate bruises, still edible but in need of paring; and potatoes with serious bruises—virtually inedible—bruise culls. Other defects of potatoes such as sunburn, greening, rot and wireworm were not considered in this grading. In other words, unless potatoes were bruised in some way, they were considered as perfect.
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Contents of each box were weighed, keeping the three groups separate. One 50-pound box might have 40 pounds of slightly bruised potatoes, 7 pounds of moderately bruised potatoes, and 3 pounds of seriously bruised ones.

Table 1—Amount of bruising in bottom three layers—216 boxes in each layer

Layer		Bruising Index*
Third from bottom		229
Second from bottom	Difference not significant.	213
Bottom layer		215
Group average		219

Car Ends

There was found to be potato bruise differences among car ends. Table 2 shows the average for the boxes in each car end.

Table 2—Amount of bruising in each car end—108 boxes in each end

Car End			Bruising Index
Car 1	End A		186
	End B		194
Car 2	End A	Differences among car ends significant at 1% level.	238
	End B		197
Car 3	End A		236
	End B		262
	Group Average		219

Car end differences mean that the potatoes being shipped were different in bruising damage before shipment or the cars were handled differently. Thus this source of bruising was because of differences in potatoes before packing or because of differences in handling the cars, but not because of packing.

Fluting

Fluting was tested because little information was available as to which type protection—vertical or horizontal—was most needed for potato shipments. For a product unable to carry any weight, as lettuce, "A" flue would be desirable. For a product able to carry a great deal of weight, as canned goods, "B" flute would be better. Potatoes are able to bear considerable weight as evidenced by "high piles" in storage cellars. Probably in shipping, potatoes need both vertical and horizontal protection.

Analysis showed fluting of boxes does affect the protection afforded potatoes. Boxes made from "B" flute were better potato boxes than those made from "A" fluting. Table 3 shows both "A" and "B" fluting boxes gave adequate protection vertically;

* The smaller the index, the less bruising.

Figure 12 — Box on bottom layer (left) shows more breakdown than next to bottom layer (center) or third from bottom (right). In spite of box breakdown, bottom layer potatoes had no more bruises than other layers.

the majoring bruising, then, came from horizontal damage. "B" flute boxes offered better protection from this type of bruising.

Table 3—Comparison of bruising damage to potatoes shipped in "A" and "B" flute boxes—324 boxes in each group

Flute		Bruising Index
A flute boxes	Difference significant	231
B flute boxes	at the 1% level.	207
Group average		219

Weight of Board

Two weights of board were used in constructing test boxes. One box, "heavy," had a 250-pounds-per-square-inch bursting strength. The other, "light" was made of 200-pound bursting strength board. Apparently, both grades of board were more than adequate for this test. There is no evidence that the boxes made with 250-pound board were superior to those made from 200-pound board. In fact, although the statistical tests show it to be non-significant, data indicate the "light" may be slightly better than the "heavy" boxes (Table 4). In any event, "light" boxes are cheaper than "heavy" boxes, and are recommended on this basis.

Table 4—Comparison of bruising damage to potatoes shipped in "heavy" and "light" boxes—324 boxes in each group

Box Strength		Bruising Index
Heavy boxes (250 lb.)	Difference not	227
Light boxes (200 lb.)	significant	211
Group average		219

Ventilation Types

Figures 2 through 10 illustrate the nine different ventilation-type boxes tested. Boxes 7 and 8 have no perforations whatsoever and are maximum strength boxes. All boxes were tested, not for ventilation, but rather on how the various type holes affect the vertical strength of the box and thus the pressure protection offered potatoes. It has already been shown in the section under *Fluting* that vertical pressure is no special problem when boxes are stacked seven high in the car. It is not surprising, then, that there were no differences among the various ventilation-type boxes tested.

The analysis shows no one ventilation type distinctly superior to the others. This means that a potato shipper may choose any of the ventilation types and feel assured the potatoes will have adequate protection. No statement can be made about ventilation types not included in this test.

Ventilation Affected By Loading Method

An interesting side aspect, here, was the quality of potatoes as affected by ventilation. This study was not designed to test air ventilation within a box. Actually, though, a record was kept of boxes that had poor ventilation. All nine ventilation types appeared satisfactory in this respect.

The two loading methods did affect ventilation. As explained in the *Procedure*, the first car had boxes loaded lengthwise. This made an extremely tight fit, allowing little or no air to circulate among the boxes. In this first car many boxes contained potatoes still wet after six days. In addition, rhizoctonia (a white fungus) was present in many of these boxes.

Cars 2 and 3 had boxes alternated by columns. The first column of boxes was placed lengthwise, the second crosswise, and so on. This latter loading allowed free movement of air among the boxes, and the potatoes were dried out at time of arrival. Little or no fungus was present in cars 2 and 3. Thus it appears as though the loading method is much more important in ventilation than the ventilation features built into the box.

Interactions

The analysis so far has shown:

1. The vertical position of the box by layer was not important; *i.e.*, a given box protects the potatoes just as well at the bottom layer as at the third from bottom layer.
2. A 200-pound board box offered as much protection as a 250-pound board box.
3. Fluting is important. "B" flute boxes gave better protection to the potatoes than "A" flute boxes. Since "B" flute

excels in horizontal protection, the main protection problem comes from horizontal bruising.

4. Ventilation. Within the types of ventilation tested, no one box appeared superior to the others.

Now, with the above results in mind, interaction between several variables was tested. In other words, does one board weight show up better with a certain fluting or ventilation type?

Fluting and Board Weight

"B" fluting was somewhat superior to "A" fluting in both heavy and light board. However, "A" fluting is satisfactory if combined with light board. It is not as satisfactory with the heavy board. Heavy paper may allow more damage to the "A" type (weaker horizontally) fluting with the forward and backward motion of potatoes.

Table 5—Comparison of potato bruising in boxes made of "A" and "B" flutes, heavy and light board—162 boxes in each group

Board	Fluting	
	A	B
Heavy	247	206
Light	214	208

Fluting and Vent Type

When using "B" flute, any ventilation type appears satisfactory. With "A" flute, several vent types do not show up as strong as the others. Therefore, use "B" flute board and eliminate worry about ventilation features of the box.

Board Weight and Vent Type

With light board, all ventilation types were satisfactory. However, with heavy board, several types do not look quite so good at protecting the potatoes. But these differences are not great enough to be statistically significant. In most ventilation types, light board was superior to heavy board.

Fluting, Board Weight and Vent Type

So far as the analysis shows, there are no joint relations among the three variables tested. "B" flute still shows up as superior to "A" flute, holding vent type and board weight constant. Light board looks better than heavy board, although there is 1 chance out of 20 that differences may be due to sampling error. No one ventilation type appears better than the others.

Recommendations

A. All boxes tested are adequate for shipping potatoes seven layers high in the car.

B. In general, "B" flute is better than "A" flute. This is true with both heavy and light board. "A" flute does appear satisfactory if combined with light (200 lb.) board.

C. Light board is better than heavy board when using "A" fluting. In "B" fluting either weight board is satisfactory.

D. Loading methods are more important than box ventilation features as regards ventilation of potatoes.

E. Each box should have some type ventilation holes, but not for strength or ventilation of potatoes. Each box should have holes, preferably in the top or top edges, for air escape or intake, in easy closing or opening of boxes. Gap flap openings are not recommended since this type opening cuts down on horizontal rigidity of the box. Hand holes might be convenient air escape holes, but their convenience factor in box handling is over-estimated.

Box Versus Burlap Cost Comparisons

Unless boxes can compete costwise with other containers, they probably will not be used extensively. At least they will not be used for shipping the bulk of Idaho potatoes now being shipped in burlap.

The following cost comparisons take into account only cost differences between burlap and cartons: container costs for two 50-pound cartons is 41.8 cents and one burlap sack is 14.5 cents. Floor pads are needed for burlap and not for boxes—a saving of about ½ cent in favor of boxes.

Not included in this comparison are costs of such automatic machines as box filling machines and automatic lid gluing and closing machines. However, additional labor costs are included for filling boxes and loading cars by hand and the costs of assembling, stapling, and handling the empty boxes, 3 cents per cwt.

Cost item	Cost per cwt. 50-lb. carton	Cost per cwt. 100-lb. burlap
Containers (Jan. 1, 1959)	$ .418	$ .145
Floor Pads		.005
Packing and loading cost difference	.005	—
Assembling boxes, labor and staples	.03	—
	$ .453	$ .15
	difference 30.3 cents in favor of burlap	

Packing cost differences are 30.3 cents ($.453 minus $.15). Thus a packer needs at least 30 cents extra for the boxed potatoes to cover his extra costs. Are potatoes in boxes worth this extra cost to receivers?

With freight rates the same for boxes as for burlap, no freight savings are possible at present with the larger potential loads of boxes. However, savings on transportation charges are now possible where these charges are on a per car basis. An example is icing. If a car of potatoes is half-stage iced at $74 per car, this icing rate per cwt, for a 360 cwt. car is 20.6 cents. For a 525 cwt. car of boxes, icing per cwt. is 14.1 cents. If a heating charge is $27.77, a 525 cwt. car has heat charge of 5.3 cents per cwt. as against 7.7 cents per cwt. for a 360 cwt. car of burlap.

The receiver of potatoes can make some handling savings with boxes since they can be more easily handled on fork trucks and roller conveyors. This saving is estimated at ½ cent per cwt. In addition, the receiver will be getting fewer bruised potatoes in boxes and the grading labor savings are estimated at 1/5 cent per cwt.

Bruising costs alone are a big item in a cost comparison such as this. Other studies have shown[1] that bruising is considerably less in boxes than in burlap. Here we are assuming 8 percent more bruised potatoes in burlap than in boxed potatoes. This additional bruising cost, estimated to be 16 cents per cwt. is based on 4 percent of the potatoes dropping from U.S. 1's to 2's and 4 percent dropping from 1's to culls. Assumed prices are $3 for 1's, $1.50 for 2's, and 50 cents for culls.

Still another cost consideration is the salvage value of burlap and boxes. In Pittsburgh, at the time of this study, used burlap bags were selling for 5 cents. Fifty-pound telescope boxes yield four grocers' carryout boxes. Estimates vary as to what these carryout boxes are worth, and here we estimate them to be worth 1.5 cents apiece. The cost of a big paper bag, 6 cents per cwt. Thus boxes have a salvage value of 1 cent more per cwt. than burlap. We might summarize burlap and box cost and salvage values as follows:

Extra cost per cwt. for 100 lb. of potatoes in burlap as compared to 100 lb. in 50-lb. cartons.

Item	
Shipping cost differences	
heating car ($27.77 per car, which is $.053 per 100 lb. in cartons or $.077 in burlap)	$ .024
Receiving cost differences	
handling cost	.005
grading cost	.002

[1] See page 4 of "New Ideas in Packing Potatoes," by Kermit Bird, University of Idaho Bulletin 284, October, 1957.

bruising cost	.16
Value of used containers	
(one burlap at $.05 vs. two telescope boxes, that is, 4 sections, at $ .015 per section)	.01
Total in favor of boxes	$ .201

With these differences in shipping, receiving, and bruising damages, the 30.3 cents packing cost difference is somewhat offset by 20.1 cents saving at the receiving end. However, there is still a difference of 10 cents in favor of burlap. (30.3 cents minus 20.1 cents)

Proposed freight rate charges could very well change the entire picture. A new rate schedule is now being proposed. For example, the proposed rates from Caldwell to Pittsburgh are:

40,000 lb. minimum $1.63¼

43,000 lb. minimum $1.58¼ These new proposed rates apply

50,000 lb. minimum $1.50¼ only to boxes, not to bags.

The present 36,000 lb. rate is $1.71¼ per cwt. The difference between the $1.71¼ present rate and the proposed rate for a 50,000 lb. minimum of $1.50¼, 21 cents, could shift the potato industry from burlap to boxes. In other words, the proposed freight rate decrease of 21 cents more than offsets the present 10 cent advantage of burlap.

Appendix

In analyzing results, analysis of variance techniques were used. All relevant information was punched on IBM cards and sums of squares were derived by machine. Analysis used in Plan B, Split Plot, Randomized Block. The objective in the design of the experiment and in the analysis was to get rather precise information on one set of treatments: fluting, weight of paper, and ventilation type. Also of interest was the effect of another variable, layers, but less precision was needed here.

The measure of a box's ability to protect the potatoes was the bruising index. A low index tells us the potatoes were graded as being only slightly bruised, the lowest possible index being 100. A moderate index, say in the range of 200 to 240, shows potatoes bruised some, but not seriously. An index of over 240 is high, indicating serious bruises. Computation of bruising index is covered in the *Procedure*.

Illustrations used in the text are in terms of averages, although in the analysis variances were used.

The following table gives degrees of freedom and mean squares:

Appendix Table 1—Source of Variation, Degree of Freedom, and Mean Squares. 648 Boxes Shipped in Three Cars.

Source of Variation	Degrees of Freedom	Mean Squares
Total	647	
Car ends	5	99,909
Fluting (A)	1	89,923
Board Weight (B)	1	40,180
Vent type (C)	8	6,010
A X B	1	47,659
A X C	8	22,648
B X C	8	16,086
A X B X C	8	11,120
error	175	20,573
Layers (D)	2	16,606
error	10	62,680
A X D	2	89,797
B X D	2	43,615
C X D	16	10,024
A X B X D	2	150,908
A X C X D	16	35,766
B X C X D	16	30,354
A X B X C X D	16	76,725
experimental error	350	2,725

Appendix Table 2—Horizontal Location of Boxes within Cars. 6 Replications. 36 box types, 18 of each type.

Car Number		1		2		3	
Car End		A	B	A	B	A	B
Row	Column						
1	1	1	36	29	22	15	8
1	2	2	31	30	23	16	9
1	3	3	32	25	24	17	10
1	4	4	33	26	19	18	11
1	5	5	34	27	20	13	12
1	6	6	35	28	21	14	7
2	1	7	6	35	28	21	14
2	2	8	1	36	29	22	15
2	3	9	2	31	30	23	16
2	4	10	3	32	25	24	17
2	5	11	4	33	26	19	18
2	6	12	5	34	27	20	13
3	1	13	12	5	34	27	20
3	2	14	7	6	35	28	21
3	3	15	8	1	36	29	22
3	4	16	9	2	31	30	23
3	5	17	10	3	32	25	24
3	6	18	11	4	33	26	19
4	1	19	18	11	4	33	26
4	2	20	13	12	5	34	27
4	3	21	14	7	6	35	28
4	4	22	15	8	1	36	29
4	5	23	16	9	2	31	30
4	6	24	17	10	3	32	25
5	1	25	24	17	10	3	32
5	2	26	19	18	11	4	33
5	3	27	20	13	12	5	34
5	4	28	21	14	7	6	35
5	5	29	22	15	8	1	36
5	6	30	23	16	9	2	31
6	1	31	30	23	16	9	2
6	2	32	25	24	17	10	3
6	3	33	26	19	18	11	4
6	4	34	27	20	13	12	5
6	5	35	28	21	14	7	6
6	6	36	29	22	15	8	1

REDUCED SHIPPING RATES FOR POTATOES IN LARGER CARLOTS AND IN CARDBOARD BOXES HAVE BEEN APPROVED

SINCE this bulletin was written the reduced shipping rates for potatoes in larger car lots and in 50 lb. cardboard boxes that are mentioned have been approved and are in effect, but not at the same rate as suggested in the preceding paragraphs. For example, the rates that have been approved for potatoes from Caldwell to Pittsburgh, the same example as used in the text are:

40,000 lb. minimum, burlap or boxes	$1.69
43,000 lbs. minimum, burlap or boxes	$1.64
50,000 lb. minimum, *boxes only*	$1.56

Any interested shipper or receiver of potatoes should investigate the new rates that would apply to his situation for Idaho potatoes in boxes. It would be to the advantage of the Idaho potato industry to get its potatoes to market in the best possible condition for the consumer.

Cooperation

The University is indebted to the following individuals and firms who made this project possible:

R. V. Hansverger, president of the Boise Cascade Corporation, and Robert Herman, district sales manager of Cascade Container Corporation, a subsidiary of Boise Cascade Corporation, for supplying boxes made to specifications for the test.

The Western Idaho Potato Growers Cooperative, managed by Cecil Kent, for allowing the use of its Caldwell packing shed for packing the 50-lb. boxes of potatoes and shipping them from its dock.
The Golden Triangle Packing Company, and Tony Corso, president, of Pittsburgh, Pennsylvania, for buying the three test carloads of potatoes and allowing use of its facilities for unloading the cars and grading the potatoes.

The Pacific Fruit Express, the Union Pacific Railroad and Potlatch Forests, Inc., for help in carrying out the project.

OTHER PUBLICATIONS ON POTATOES
ISSUED BY THE UNIVERSITY OF IDAHO
COLLEGE OF AGRICULTURE

An Analysis of Potato Packing Costs in Idaho—1950-51 Season, Exp. Bul. 208.

A Study of Simulated Hail Injury to Potatoes. Res. Bul. 22.

Diseases of Potatoes in Idaho. Exp. Bul. 254.

Effects of Mechnical Injury Upon the Storage Losses of Russet Burbank Potatoes. Exp. Bul. 220.

Fertilizer Studies on Russet Burbank Potatoes in Southern Idaho. Exp. Bul. 281.

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Verticillium Wilt of Potatoes in Idaho. Research Bulletin 13.

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