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B521: Containers for Shipping Apples

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CONTAINERS FOR SHIPPING APPLES

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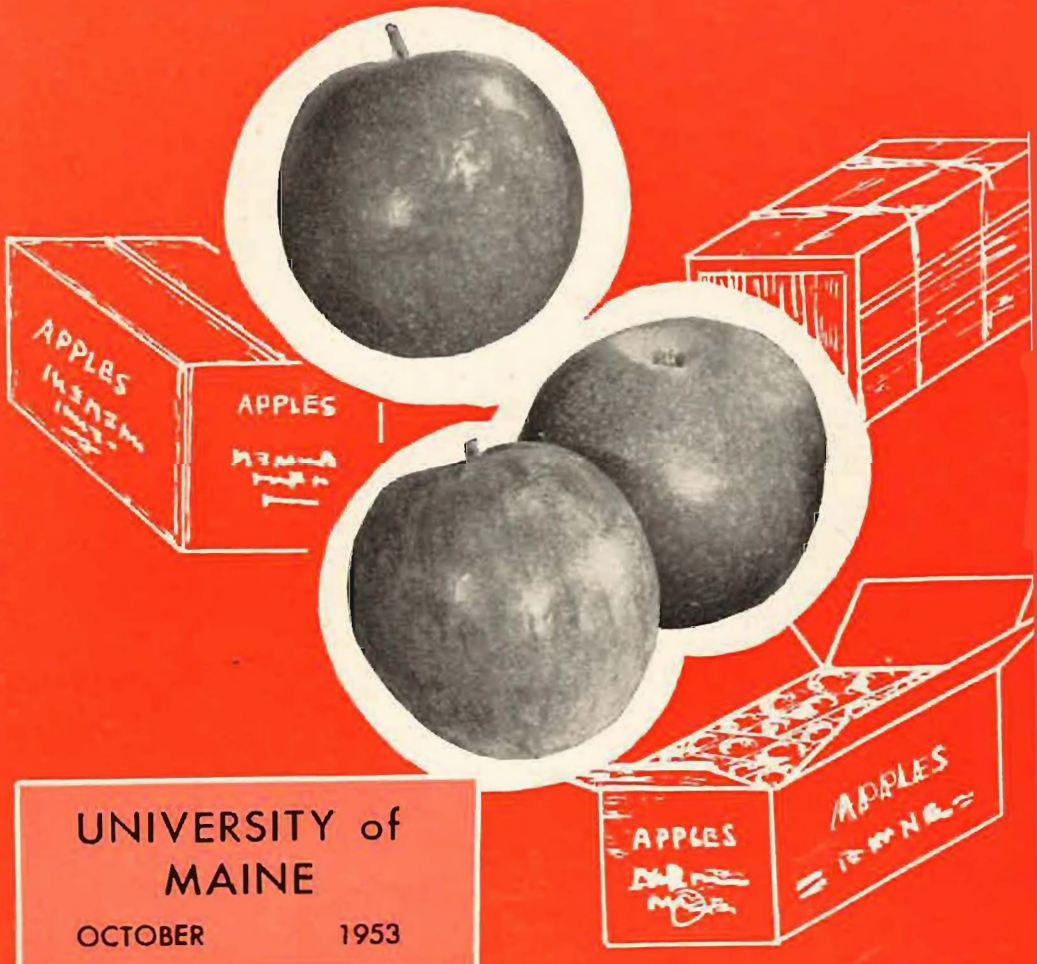

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SUMMARY

McIntosh apples, the most popular variety in Maine, are very susceptible to bruising which seriously affects the quality of the fruit. It has been shown that much of the bruising can be prevented by proper packaging and handling.

The apples used in this study which was conducted during two marketing seasons, 1951-52 and 1952-53, were graded and packed by hand at Highmoor Farm (Monmouth, Maine) and shipped by farm truck to Portland, Maine; one-half of each shipment went directly to retail stores and one-half to the warehouses serving these stores. Other shipments were made by truck to Augusta and then by railway express to Kingston, Rhode Island. These tests were conducted in three shipping periods—early, midseason, and late—so that observations of bruising could be made at different stages of maturity of the fruit. The fruit was carefully examined for bruising and classified according to U. S. standards at the farm and again upon arrival at the destinations indicated.

Eleven containers of three types—wooden boxes, corrugated and wirebound—were tested for their ability to protect apples from bruising in transit. Five of the bushel-sized containers tested were made especially for these tests. The remaining six were (and are) in commercial production. The materials used in the various tray and layer packs were: moulded pulp trays (two kinds), 3-Ply Cushions, Chipboard, Kimpak, and corrugated flats and partitions, all of which are readily available commercially. An additional packing method was also studied; apples were packed in 2-pound polyethylene bags and these, in turn, were placed in corrugated master containers.

Apples in the cell pack in the corrugated box showed the least amount of bruising of the containers and packs used. The tray packs were second and in most cases were satisfactory except for distant shipments. Apples in jumble packs showed the most bruising. The jumble pack was found unsatisfactory for a commercial pack of good quality McIntosh apples.

Apples packed in polyethylene bags showed as much bruising as jumble-packed apples in boxes. Wooden boxes made up especially for these tests did not, in this limited study, prevent a sufficient amount of bruising to much more than offset the additional cost of the container. There was little apparent difference in the protection afforded the fruit by the different materials used for layer packs.

In determining the practicability of various containers and

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packs, consideration was given to the cost of containers and material and the value of apples affected by bruising in transit.

Layer and tray packs, both in wooden and corrugated boxes, were most satisfactory; they were satisfactory both in direct shipment to retail stores and in shipment through wholesale warehouses, especially when apples were high priced. For rough handling and distant shipments, the corrugated cell pack is preferred. The lower cost of the layer pack is largely offset by larger amounts of bruising. Jumble packs were unsatisfactory for quality fruit.

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CONTAINERS FOR SHIPPING APPLES

HOMER C. WOODWARD[1]

INTRODUCTION: BACKGROUND AND PURPOSE

The McIntosh is the most important apple variety grown in New England. The apples of this most popular variety are easily bruised. Careful handling of McIntosh apples is necessary not only on the farm and in the packing shed but also in shipment and on retailers' display counters. Since careful handling is not always obtained in the various phases of distributing and selling McIntosh apples, improvement in the containers is the primary avenue open in maintaining quality and reducing losses.

Studies since 1946 affirm that the major causes of apple bruising in Maine are the methods used in packing the containers, layer materials, and handling. During the past two years, the emphasis of the studies has been testing of different containers and packing materials to determine which give the apples the best protection.

Those who pack apples have become increasingly conscious of the higher costs involved. Therefore, the cost of the various containers and packaging materials also was studied. Thus, the overall objective of the study was to determine what type(s) of container or containers and materials give the best protection to the fruit at the most favorable cost relating to the returns, that is, which containers and materials are the most practical all things considered.

SCOPE AND METHOD OF STUDY

In this study, 683 bushels of apples were hand-graded and packed at Highmoor Farm—the Experiment Station farm about 15 miles from Augusta, Maine—and shipped to one of three destinations: retail stores and warehouses in Portland, Maine, and the Rhode Island Agricultural Experiment Station at Kingston.

Shipment of the 683 bushels was made during two seasons, the 1951-52 and the 1952-53 seasons. In each of the two "shipping seasons" there were three shipping periods. These were early, midseason, and late. The shipping periods were so selected that the apples could be examined and classified in different stages of maturity.

The apples shipped to Portland (48 miles from Highmoor) were transported by truck. One-half of each shipment to Portland went di-

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rectly to cooperating retail stores and one-half went to warehouses serving these stores. Apples delivered to the warehouses were distributed to the cooperating retail stores by company truck the following day. In all, 308 bushels were delivered directly to the stores and 282 bushels were delivered to the warehouses. Those shipped to Kingston were taken by truck to Augusta (15 miles) and then shipped by railway express to Kingston (240 miles).

Interpretation of U. S. Standards

The U. S. Standards for Apples states that U. S. Extra Fancy grade apples are allowed only *slight* bruising incidental to proper handling and packing. Apples of U. S. Fancy or No. 1 grade have the same requirements for bruise damage with one exception; *slight* is omitted from the definitions. Apples of the U. S. Utility grade have to be free from serious damage caused by bruising.

Three grades were used in classifying the apples: U. S. Extra Fancy, U. S. Fancy or No. 1, and U. S. Utility. Apples free of bruises which may have detracted from their appearance were placed in the Extra Fancy class. Apples graded U. S. Fancy had bruises which detracted "somewhat" from their appearance. This bruising was considered (or called) "slight to moderate." Apples of the U. S. Utility grade had to be free from "serious damage" by bruising, but were permitted to have more and larger bruises than the other grades as long as there was no softening or breakdown of the apple tissue.

In grading and packing the apples, the packer carefully picked up the apple and turned it in his hand, observing the approximate number, size and depth of bruises. From this observation, the packer determined the grade under which the apples were classified. Apples having stem punctures were recorded. However, it was the general practice not to pack apples with stem punctures. The apples were examined by the same method on arrival at their destinations.

Method of Packing Apples for Shipment

The apples were packed as jumble, layer, cell and tray packs and in two-pound polyethylene bags in corrugated master containers. The jumble pack, which has been used for a number of years in Maine, is the easiest method of packing apples for market and is also one that causes much damage to the fruit.

With the exception of 2½-inch apples, all apples in layer packs were packed in an off-set system (Fig. 1). With the exception of six boxes packed in combination size 2½ and 2¾ inches, all boxes contained one of three sizes of apples, 2½, 2¾ or 3 inch.

FIGURE 1. Layer packed apples in single wall corrugated box. The packing material is a 3-Ply Cushion and the apples are arranged in an "offset" manner.

Cell packed apples were in corrugated boxes complete with corrugated flats and partitions. The tray pack refers to moulded pulp trays placed in boxes. These pulp trays were used in large wirebound, both the single and double wall corrugated boxes, and the large wooden box. In the majority of layer and tray packs the apples were packed stem up. However, all apples in cell packs were packed cheek up. The polyethylene bags were filled by hand, closed with bag labels and placed in the master container in two layers of nine bags each.

CONTAINERS AND PACKING MATERIALS

Eleven Container Types in Test

Eleven kinds of containers were tested, each with a capacity of approximately one bushel of apples by volume. The 11 containers were: five kinds of corrugated boxes, four kinds of wooden, nailed boxes and two kinds of wirebound boxes (Table 1).

Moulded pulp trays were used in one "special-sized' wooden box, two specially designed corrugated boxes and one wirebound box. These boxes were all approximately the same size, about 2820 cubic inches in volume. The Universal wirebound box and the Eastern apple box were used as both jumble and layer pack containers.

TABLE 1

Type of Container, Inside Dimensions, Volume and Methods of Packing Apples 1951-53

Type of Container	Approx. Inside Dimensions L x W x H	Approx. Volume[1]	Method of Packing
	(inches)	(cubic inches)	
Wood			
Eastern Box	17 x 13 x 11	2431	Jumble and Layer
Mod. Eastern Box	17 x 13 x 11¾	2596	Layer
Special Wood Box	15 x ¾ x 14 x 12⅛	2674	Layer
Tray Pack Box	20 x 12 x 11¾	2820	Tray
Corrugated			
Single Wall Tray Pack	20 x 12 x 11¾	2820	Tray
Double Wall Tray Pack	19¾ x 12 x 11⅜	2820	Tray
Single Wall Layer Pack	17 x 13 x 11¾	2596	Layer
Double Wall Layer Pack	17 x 13 x 11¾	2596	Layer
Single Wall Cell Pack	160 Count 2½" Apples		Cell
	112 Count 2¾" Apples		Cell
Wirebound			
Universal	16¾ x 11 15/16 x 11 15/16	2386	Jumble and Layer
Tray Pack	20 x 12 x 11¾	2820	Tray

[1] Volume for one standard bushel, 2150 cubic inches.

Wirebound Containers

Wirebound boxes are made of wood about ⅛-inch thick and bound by steel wire, which gives the box strength. The cover was attached to the box. This type of container is very popular for shipping many agricultural products. The small wirebound box used in these tests is called the Universal wirebound crate. The larger wirebound is designed for moulded pulp trays or for 5 lb. bags of apples and its construction is the same as the smaller wirebound box (Fig. 2).

Corrugated Containers

Of the corrugated boxes designed to use the moulded pulp tray, one was a single wall box with die-cut handles in the ends of the box. A foldover cover was used for closing the box. This box was also used as a master container for polyethylene bags. The other corrugated box had a double thickness of corrugated board on the ends and bottom, die-cut handles and a foldover cover. This box was stronger and better constructed for stacking and shipping than the single wall box.

The two corrugated boxes designed to be used as layer packs were regular slotted corrugated containers. One was a single wall box and the other a double wall box with double thickness throughout, giving it added stacking and shipping strength. The corrugated boxes used for cell packs were single wall regular slotted container with flats and double face partitions for protecting each individual apple in the layer. The cell packs varied in size depending on the size of apples packed.

Wooden Containers

The four wooden boxes were made of ⅜-inch pine boards and were assembled with nails. These boxes were of the same general construction

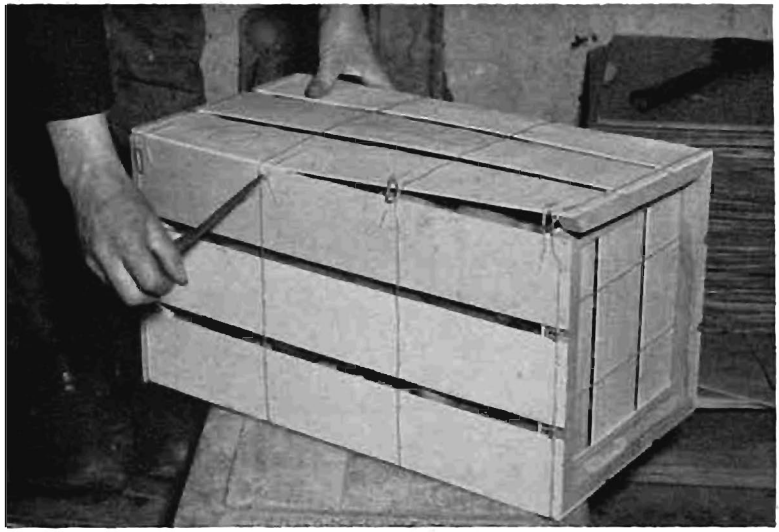

FIGURE 2. Universal wirebound box used with tray, layer, and jumble packs. Method of closing box is shown.

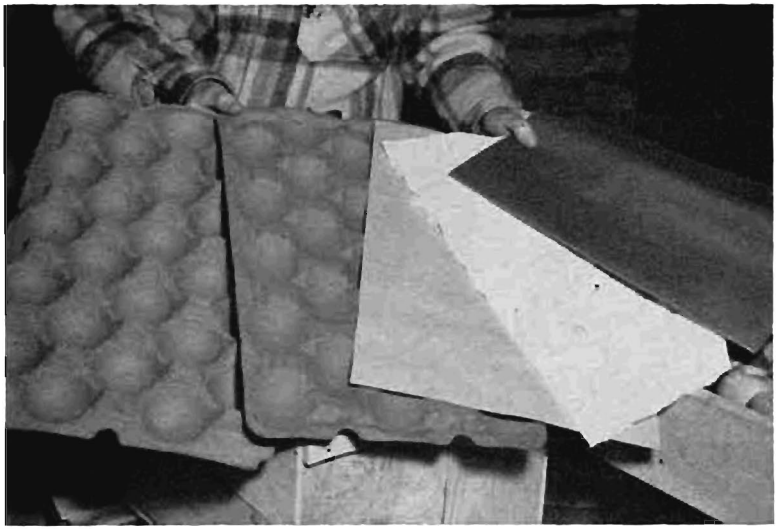

FIGURE 3. Tray and layer packing materials used in tests are (left to right) Friday tray, Keyes tray, Chipboard, Kimpak and 3-Ply Cushion. For cellpack see cutaway view in Fig. 6.

but varied in dimensions. One was the Eastern apple box which has been used in Maine for a number of years as an orchard, storage and shipping container. It has been generally used as a jumble pack but in the past few years some packers have been layer packing apples in these boxes. Another was the modified Eastern apple box, ¾ inch higher than the regular apple box, so designed to make it more suitable for layer packing apples. The special wooden box was used for layer packing only. The tray pack wooden box was designed for moulded pulp trays. Two or three slats are sufficient for closing the wooden boxes. If boxes were to be subjected to much handling it was found that three slats were more desirable. Veneer box tops were used to close some of the wooden containers.

FIVE LAYER MATERIALS, ONE "CONSUMER PACKAGE" TESTED

Five types of layer and tray pack materials and one type of consumer package were used in the containers tested (Fig. 3). The materials were moulded pulp trays, Kimpak, Chipboard, 3-Ply Cushions, corrugated flats with double faced partitions and 2 lb. polyethylene bags. Two types of moulded pulp trays were used, Keyes and Friday. Both are of the same general cupped design and purple in color; the Friday tray has slightly deeper cups than the Keyes. The size of the fruit packed determines what count tray should be used, for example, 150 count for 2½ inch, 125 count for 2¾ inch and 100 count for 3 inch apples.

Kimpak is a very soft felt-like material about ¼-inch thick and white in color. Chipboard is a pressed board material, gray in color and fairly rigid. There are several thicknesses of Chipboard but thick board is preferable for layer packing. The 3-Ply Cushions consist of three pieces of pebbled cardboard covered with heavy purple paper. This type of material has a cushion effect and at the same time there is considerable rigidness to give support to each layer. The corrugated flats and partitions were furnished with the containers. For consumer packages, ventilated polyethylene bags were used.

All of the packing materials used in this study are produced commercially and can be obtained from a number of sources. In these tests, each container, with the exception of some cell packs, the polyethylene bag and jumble packs, had five layers of fruit. It was the practice to place a piece of the material on a tray over the top of the apples; therefore, six pieces of material or trays were used in each container.

EFFECT OF DIRECT, WAREHOUSE, AND RAILWAY EXPRESS SHIPMENTS ON APPLE QUALITY

About 93 per cent of the apples were U. S. Extra Fancy grade when packed (Table 2). Each apple was examined for bruising as it was placed in the container.

TABLE 2

Grades of McIntosh Apples Packed at Highmoor Farm and the Grades as Received at Portland, Maine, and Kingston, R. I., 1951-53

	Highmoor Farm		Portland, Maine			
Delivery	Ex. Fancy	Fancy—No. 1	Ex. Fancy	Fancy—No. 1	Utility	Culls
	(Per Cent)		(Per Cent)			
Direct	93.1	6.9	87.9	11.5	.4	.2
Wholesale	92.9	7.1	79.2	17.4	2.4	1.0
			Kingston, Rhode Island			
Railway Exp.	94.5	5.5	33.6	28.5	28.0	9.9
Average	93.3	6.7	76.9	16.3	5.0	1.8

During the two years (shipments made to Portland, Maine, and Kingston, Rhode Island), it was found that apples shipped directly to the retail stores in Portland incurred the least amount of bruising. Of the 93 per cent of the apples considered U. S. Extra Fancy grade on examination at Highmoor, about 88 per cent were of the same grade on arrival at the retail stores (Table 2 and Fig. 4). Apples shipped through the warehouse and then to the retail stores in Portland had upon arrival about nine per cent less apples of U. S. Extra Fancy grade. Nearly four percent were below U. S. Fancy or No. 1 grade as compared to less than one per cent of this grade for direct shipments.

Apples shipped to Rhode Island incurred the most bruising. Over 94 per cent of the apples shipped to Rhode Island were considered U. S. Extra Fancy grade when examined at Highmoor Farm. However, on arrival at Kingston examinations showed that only about 34 per cent were of that grade and nearly 38 were U. S. Utility grade and Culls.

The results of these shipments indicate that the more handling McIntosh apples receive and the further they are shipped the greater the amount of bruising (Fig. 5).

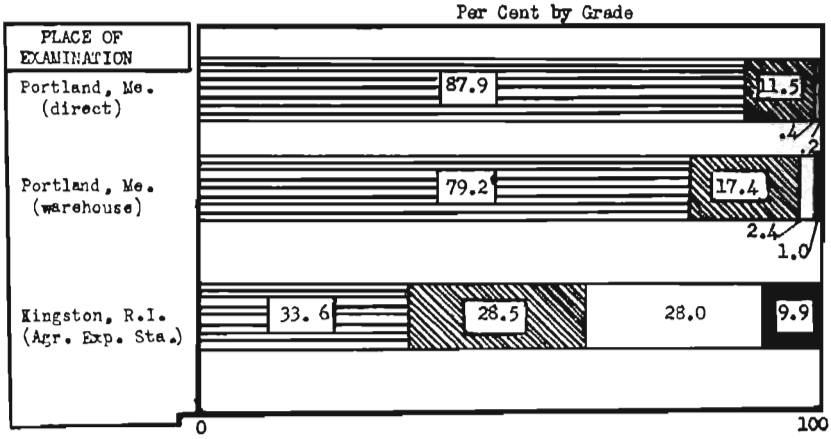

FIGURE 4. Grades of McIntosh Apples on Arrival at Destinations. (Grades listed in order—left to right on bars—U. S. Extra Fancy, U. S. Fancy or No 1, U. S. Utility and Culls.)

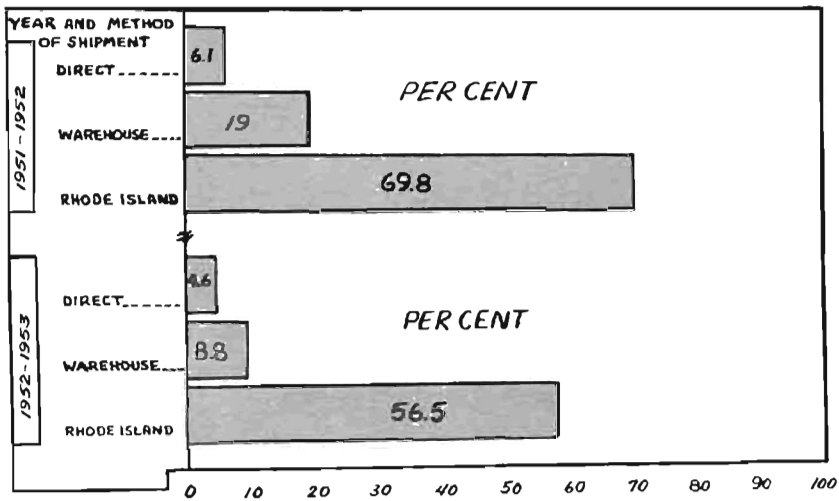

FIGURE 5. Increase of McIntosh Apples to Lower Grades (below U. S. Extra Fancy) Because of Damage in Shipment. 1951-53. In both seasons, more than half the apples in the shipments to Rhode Island were bruised enough so that they were classified in a lower grade.

CONTAINERS COMPARED ON BASIS OF BRUISING AND COSTS

Bruising Comparisons

Considerable variation was found in the amount of bruising and stem punctures occurring on apples shipped to the two destinations in the various containers (Table 3). In addition, there was some variation in the amount of bruising found on apples in the same types of containers using different materials between layers of apples.

TABLE 3

Per Cent Increase of McIntosh Apples to Grades Below U. S. Extra Fancy in Various Types of Containers, 1951-53

Type Container and Material	1951-52			1952-53		
	Portland			Portland		
	Direct	Whse.	R. I.	Direct	Whse.	R. I.
	(Per Cent)					
Jumble Pack						
Eastern Wood Box	23.6	37.9	84.1	11.2	39.0	—
Universal Wirebound	8.7	44.3	—	—	—	—
Layer Pack						
Eastern Wood Box Kimpak	3.8	27.0	—	—	—	—
Eastern Wood Box Chipb'd.	7.5	19.7	—	—	—	—
Eastern Wood Box 3-ply	8.3	21.1	64.6	—	—	—
Universal Wirebound Kimpak	3.1	46.7	—	—	—	—
Universal Wirebound Chipb'd.	7.6	43.0	—	—	—	—
Universal Wirebound 3-ply	9.4	53.4	86.6	—	—	—
Mod. Eastern Wood Box Kimpak	7.5	17.5	—	—	—	—
Mod. Eastern Wood Box Chipb'd.	6.9	18.0	82.6	3.1	9.1	75.9
Mod. Eastern Wood Box 3-ply	7.7	15.4	77.0	4.7	4.9	62.9
Special Wood Box Chipb'd.	—	—	—	5.8	7.1	—
Special Wood Box 3-ply	—	—	—	5.0	5.0	60.4
S. W. Corr. Chipb'd.	—	—	—	3.3	8.8	73.6
S. W. Corr. 3-ply	—	—	—	4.1	5.2	55.6
D. W. Corr. Chipb'd.	—	—	—	2.6	5.4	59.7
D. W. Corr. 3-ply	—	—	—	3.3	5.9	53.9
Tray Pack						
Tray Pack Wood Box	3.1	11.0	56.5	2.3	4.3	47.1
Wirebound Tray Pack	2.8	11.4	68.2	—	—	—
D. W. Corr. Tray Pack	2.4	8.8	58.3	1.7	3.7	41.8
S. W. Corr. Tray Pack	3.9	10.1	—	—	—	—
Corr. Cell Pack	—	—	—	5.0	3.3	22.4
2# Polyethylene Bag in Corr. M.C.	—	—	—	17.0	31.2	—
Average	6.1	19.0	69.8	4.6	8.8	56.5

The cell pack in the corrugated box gave the best protection to the apples shipped (Fig. 6). This was especially noticeable where apparently rough handling occurred in the express shipments to Rhode Island. The per cent increase in bruising was 5.0 per cent for direct shipments, 3.3 per cent for warehouse shipments, and 22.4 per cent for Rhode Island shipments. These percentages of bruises compare favorably with tray pack apples to Portland but about doubled the amount of bruising occurring with apples shipped to Rhode Island. Apples in cell packs had

a few more stem punctures than apples in tray packs. The main reason for this increase of stem punctures was the method of packing. The apples were packed cheek up in the cell; the stem of the apple quite frequently bent back, puncturing the fruit.

Tray packs ranked second from the standpoint of protecting the fruit against bruising which would lower the grade of the apples. The double wall corrugated tray pack box and the wooden tray pack box were the two most satisfactory tray pack containers. Apples in tray packs showed the smallest increase in stem punctures.

In 1952-53, results showed that layer packs compared very favorably with tray and cell packs in both direct and warehouse shipments to Portland, Maine. Of the six containers tested as layer packs, the single and double wall corrugated boxes and the modified eastern wooden box were the most satisfactory. In general, there was little difference in the protection afforded the apples by 3-Ply Cushions, Kimpak, and Chipboard.

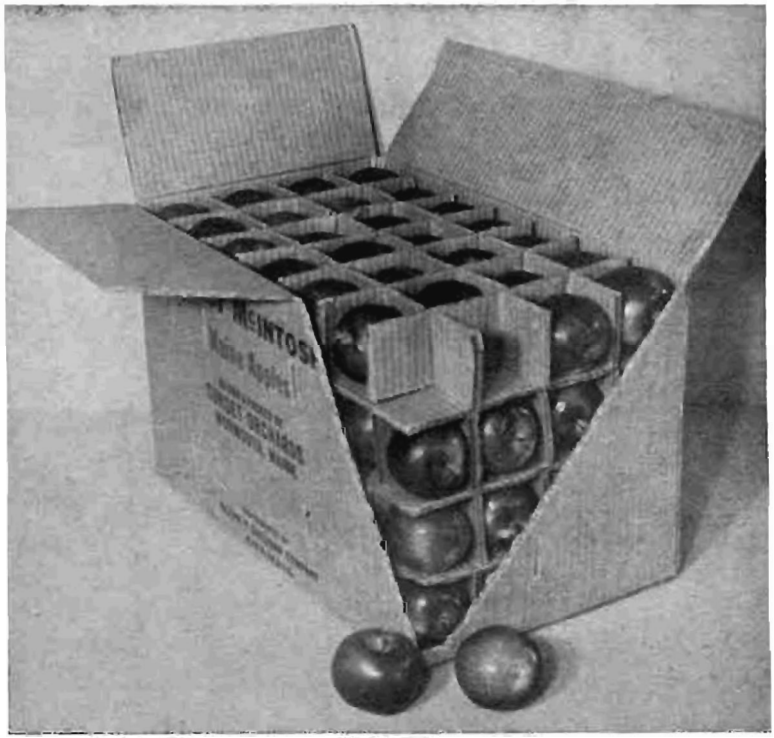

FIGURE 6. Cutaway view of cell pack in corrugated box. The cell pack material and box are delivered flat and are assembled at packing shed. Apples maintained grade better in the cell pack than in other packs. Cost was comparatively low.

Jumble packs showed the largest amount of bruising in direct shipments to retail stores and to wholesale warehouses in Portland and also was among the highest in express shipments to Rhode Island. This situation existed during the two years of the study with both direct and warehouse shipments. No comparison may be made between years on shipments to Rhode Island since no jumble packs were sent to Rhode Island the second year. In general, there was a much greater increase of apples with stem punctures in the jumble pack than in any other type of pack.

Cost Comparisons

Prevention of bruising alone is not enough to measure the practicability of a container. The container's cost, including packing materials (Table 4), must be weighed against the actual loss in apple value which might, and probably would, have occurred. The latter is difficult to determine since a commercial pack of apples need not have all apples of the same grade, so long as it meets the minimum requirements of the grade. Tolerances are in grade standards for the very reason that it is impossible to be absolute in this respect and to allow for human error in judgment.

In the test shipments various amounts of bruising occurred to individual apples. In some instances this bruising did not lower the grade of the box as a whole; in other instances, the grade was lowered from that packed at Highmoor Farm.

To have a comparison of the amount of bruising occurring in handling McIntosh apples, each apple was carefully examined as previously

TABLE 4

Approximate Costs of Various Apple Containers and Materials Used in this Study 1951-53

Container	Container Costs	Cost of Containers and Materials for Various Packs				
		Chipboard	Kimpak	3-Ply Cushions	Moulded Trays	Jumble
	(cents)	(cents)	(cents)	(cents)	(cents)	(cents)
Eastern Wood Box	36.0	46.5	48.0	52.5	—	36.0
Universal Wirebound Box	36.0	46.5	48.0	57.5	67.0	36.0
Mod. Eastern Wood Box	38.0	48.5	50.0	54.5	—	—
Special Wood Box	40.0	50.5	52.0	56.5	—	—
S. W. Corrugated Box, Hinge Cover	18.3	28.8	30.3	34.8	—	—
S. W. Corrugated Box, Fold Over Cover	30.0	—	—	—	57.0	—
D. W. Corrugated Box, Hinge Cover	27.3	37.8	39.3	43.8	—	—
D. W. Corrugated Box, Fold Over Cover	41.5	—	—	—	68.5	—
Corrugated Cell	45.0	Complete with flats and partitions.				
Polyethylene Bag	67.8	18 Bags with Master Container.				

described and a record made of the grade. Then, current prices for these grades of apples were applied to determine the loss in value that would have occurred had the apples in the box been separated by grade and so priced.

The actual cash loss from bruising for a box of apples depends on two factors: (1) whether or not sufficient bruising occurred to lower the grade for the box, and (2) the price of apples.

The average price of U. S. Extra Fancy and U. S. Fancy McIntosh apples for the 1951-52 season (November to March) was $2.50 a box. The next season, 1952-53, the average price of this quality of apples had doubled, $5.00 a box. In the latter season, therefore, a lowering in grade for the box would mean a greater cash loss and consequently a more expensive box could be used to protect the fruit.

McIntosh apples delivered directly to retail stores showed relatively little bruising and only a few apples were of lower grade than when packed, regardless of the containers used. More bruising occurred when apples were routed through wholesale warehouses to retail stores where two or more additional handlings of the boxes were necessary. This resulted in an increased amount of bruising and more apples were of a lower grade. Shipments to distant points, involving still more handling, such as shipments to Rhode Island by a combination of truck and railway express, showed extensive bruising and many apples were of lower grade than when packed (Figs. 4 and 5).

The amount of bruising depends on the protection the containers and packaging materials afford the fruit. Results of the two-year study show that some containers and packs may be satisfactory for direct shipments to retail stores but unsatisfactory for shipments requiring considerable handling.

Layer and tray pack fruit arrived at retail stores both directly and through wholesale warehouses in relatively satisfactory condition. Considering the amount of fruit bruised and the cost of the container, the layer and tray packs, both in wooden and corrugated boxes, seemed to be the most practical of all packing methods (Table 5). However, for rough handling and for distant shipments, these packs were not as satisfactory as the cell pack, especially when apples were relatively high priced. (It should be noted that fruit showing little bruising increases the volume of sales in retail outlets and that this indirectly benefits the shipper. In instances where bruising is high, the effect of the general appearance of the fruit on volume of sales and reputation should be considered as well as the immediate costs.)

Jumble packed apples in Eastern wooden boxes and in universal wirebound boxes showed considerable bruising even in direct shipments

TABLE 5

Cost of Various Containers and Packs and Losses in Quality of Apples Bruised in Transit for the Marketing Season, 1951-52

Kind of Package		Cost of Package		Losses in Quality of Apples by Bruising			Total Cost		
Container	Pack	Container	Material	Direct	Wholesale	R. I.	Direct	Wholesale	R. I.
		(cents)	(cents)	(cents)	(cents)	(cents)	(cents)	(cents)	(cents)
Eastern Wooden Box	Jumble	.36	.00	.13	.21	.94	.49	.57	1.30
	Kimpak	.36	.12	.02	.16	—	.50	.64	—
	Chipboard	.36	.10	.05	.13	—	.51	.59	—
	3-Ply	.36	.16	.06	.16	.52	.58	.65	1.04
	Tray Pack	.36	.27	.02	.07	.49	.65	.70	1.12
Modified Eastern Wood Box	Kimpak	.38	.12	.04	.13	—	.54	.63	—
	Chipboard	.38	.10	.04	.13	.70	.52	.61	1.18
	3-Ply	.38	.16	.05	.12	.84	.59	.66	1.38
Universal Wirebd Box	Jumble	.36	.00	.04	.28	—	.40	.64	—
	Kimpak	.36	.12	.02	.44	—	.50	.92	—
	Chipboard	.36	.10	.04	.35	—	.50	.81	—
	3-Ply	.36	.16	.05	.54	.79	.57	1.06	1.31
	Tray Pack	.36	.27	.02	.08	.50	.65	.71	1.13
S.W. Corr. Box	Chipboard	.18*	.10	—	—	—	—	—	—
	3-Ply	.18*	.16	—	—	—	—	—	—
	Tray Pack	.30*	.27	.02	.07	—	.59	.64	—
D.W. Corr. Box	Chipboard	.27†	.10	—	—	—	—	—	—
	3-Ply	.27†	.16	—	—	—	—	—	—
	Tray Pack	.41†	.27	.02	.05	.52	.70	.73	1.20

* A die cut hinge cover box.
† A fold over cover box.

TABLE 5—Concluded

Cost of Various Containers and Packs and Losses in Quality of Apples Bruised in Transit for the Marketing Season, 1952-53

Kind of Package		Cost of Package		Losses in Quality of Apples by Bruising			Total Cost		
Container	Pack	Container	Material	Direct	Wholesale	R. I.	Direct	Wholesale	R. I.
		(cents)	(cents)	(cents)	(cents)	(cents)	(cents)	(cents)	(cents)
Eastern Wooden Box	Jumble	.36	.00	.11	.60	—	.47	.96	—
	Kimpak	.36	.12	—	—	—	—	—	—
	Chipboard	.36	.10	—	—	—	—	—	—
	3-Ply	.36	.16	—	—	—	—	—	—
	Tray Pack	.36	.27	.03	.07	.90	.66	.70	1.53
Modified Eastern Wood Box	Kimpak	.38	.12	—	—	—	—	—	—
	Chipboard	.38	.10	.05	.13	1.53	.53	.61	2.01
	3-Ply	.38	.16	.07	.08	1.21	.61	.62	1.75
Special Wooden Box	Chipboard	.40	.10	.08	.10	—	.58	.60	—
	3-Ply	.40	.16	.07	.06	1.02	.63	.62	1.58
Single Wall Corr. Box	Chipboard	.18*	.10	.05	.12	1.56	.33	.40	1.84
	3-Ply	.18*	.16	.06	.07	.95	.40	.41	1.29
	Tray Pack	.30*	.27	—	—	—	—	—	—
Double Wall Corr. Box	Chipboard	.27†	.10	.03	.07	1.09	.40	.44	1.46
	3-Ply	.27†	.16	.05	.08	.92	.48	.51	1.35
	Tray Pack	.41†	.27	.03	.05	.84	.71	.73	1.52
Corr. Cell Pack		.45	—	.07	.05	.30	.52	.50	.75
2# Polyethylene (18)		.30‡	—	.22	.47	—	.52	.77	—

* A die cut hinge cover box.
† A fold over cover box.
‡ Single wall corrugated box for master container.

to retail stores where limited handling occurred. However, due to the low cost of the container, it ranked favorably with other types of containers in direct shipments during seasons of relatively low prices for apples. For shipments through warehouses and to distant points (most Maine apples move to market via these channels), the jumble pack is unsatisfactory (costly).

Apples packed in polyethylene bags at the farm showed considerable bruising both in direct shipments to retail stores and also in shipments routed to retail stores through wholesale warehouse. The polyethylene bags containing the apples were carefully packed in a single wall corrugated box used as a master container. Perhaps slightly less bruising would occur in a corrugated box having cell compartments. However, this was not tested. On the basis of these studies this is not a desirable method of shipping apples, considering the costs of the containers and the large amount of bruising.

The corrugated cell pack showed the least bruising in the shipments to Rhode Island. While one shipment furnishes insufficient information to draw definite conclusions, this container would seem to give the maximum protection to apples. Also, the cost of the container was relatively low since the additional cost of the unit was offset by the value of the protection it gave the fruit.