

12-1956

B553: Consumer Packages for Maine McIntosh Apples

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Merchant, C.H., E.E. Gavett, J.W. Underwood, and F.J. McDonald. Consumer packages for Maine McIntosh apples. Maine Agricultural Experiment Station Bulletin 553.

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CONSUMER PACKAGES FOR MAINE MCINTOSH APPLES

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ACKNOWLEDGMENT

The authors extend their appreciation to the following persons and organizations for assistance and cooperation in this study.

The Great Atlantic and Pacific Tea Company and the First National Stores, Inc., Portland, Maine, assisted by conducting the sale of McIntosh apples in their supermarkets in the Portland market area.

Keith Leighton and Kennard Beal assisted in setting up displays and keeping daily records of retail sales.

David Tolman, Agricultural Editor, Maine Agricultural Experiment Station, Orono, Maine, did the photography.

Cook Box Company, Cumberland Mills, Maine; Ellis Paperboard Products Company, Portland, Maine; International Paper Company, Topsham, Maine; Nashua Corporation, Nashua, New Hampshire; and Robert Gair Company, Inc., East Winthrop, Maine, supplied the packaging material for the tests.

Joan Bouchard, Barbara Higgins and Dorothy Nathan assisted in tabulating and analyzing the material.

This project was planned by Charles H. Merchant and Earle E. Gavett. The latter was in charge of gathering material and conducting the field work. John W. Underwood of the Division of Markets, Maine Department of Agriculture, was in charge of inspecting the apples and responsible for maintaining the uniform quality of fruit in the store displays. Frank J. McDonald, superintendent of the Experiment Station's Highmoor Farm at Monmouth, supervised the grading, packaging and the transportation of the apples to chain warehouses in Portland. Charles H. Merchant tabulated and analyzed the information and wrote the manuscript.

CONTENTS

	PAGE
SUMMARY	4
INTRODUCTION	6
METHOD OF STUDY	7
McINTOSH APPLE SALES IN CONSUMER PACKAGES	8
McINTOSH SALES LARGEST DURING LAST THREE DAYS OF EACH WEEK	10
LESS GRADE BRUISING OF APPLES IN CONSUMER PACKAGES	11
SLIGHTLY MORE BRUISING IN BOTTOM LAYER OF MASTER CONTAINERS	13
APPLES IN CENTER OF CONSUMER PACKAGES RECEIVED MOST BRUISES	15
STRONGER MASTER CONTAINERS GAVE BETTER RESULTS	19

SUMMARY

Modern retail food merchandising requires the prepackaging of nearly all produce and grocery items. Apples are no exception especially where the trend is toward 100 per cent self-service merchandising. Retail stores do not have the facilities or the trained personnel to prepackage the large number of the commodities found in the grocery store.

For the past two years attention has been given to the development of acceptable consumer packages and improved master containers. After much experimentation, three new consumer packages and two master containers have been developed. One consumer package developed was a long narrow polyethylene bag, another was a polyethylene bag with a divider insert and the third package had a cell partition placed in a similar plastic bag. Two weights of corrugated material were used in the construction of specially designed master containers.

A rotational latin square design was used in six supermarkets in the Portland, Maine market area for a six-week period to measure consumers' acceptance of three different consumer packages of McIntosh apples. For the first three weeks these packages were all priced at 29 cents for three pounds of apples. During the second three weeks the price of the jumble-pack poly bags remained at 29 cents and the cell and divider packages were priced at 33 cents.

All three packages were well accepted by consumers in the Portland market. In the first three weeks when all three packages were priced the same (29 cents for three pounds of apples), 40.5 per cent of the sales were in jumble-pack poly bags, 29.1 per cent in the poly bag with a divider and 30.4 per cent of the sales were of the poly bag with cell insert. In the second three weeks when the divider and cell packs were priced at 33 cents and the jumble-pack poly bags at 29 cents, sales in jumble-pack poly bags represented 44.4 per cent, the divider package 25.2 per cent and the cell container 30.4 per cent.

McIntosh apple sales (in the test packages) during the last three days of each week averaged 75 per cent of the weekly sales for the first period and 79 per cent for the second period.

Apples in the three consumer packages transported from Highmoor Farm to the supermarkets in Portland via wholesale warehouses received fewer grade and minor bruises than apples transported in tray packs. Stem punctures were the most common in the consumer jumble-pack as the fruit had apple to apple

contact. Nearly all the bruises and stem punctures occurred on the cheek of the apple. Relatively little injury was found on the stem or calyx ends.

The apples in consumer packages in the bottom layer of the master containers showed more major and minor bruises than in the other two layers. Likewise, apples in the bottom of the tray packs had the most bruising. In general, apples in the center of consumer packages had more bruises than apples in other parts of the containers.

One of the special corrugated master containers developed had a test strength of 200 pounds and the other 275 pounds. Apples in the 275-pound test container showed slightly less bruising than those in the lighter weight container.

A limited number of one kind of the containers had an asphalt laminated layer to prevent the absorption of moisture. Another small lot of containers was chemically treated to resist moisture absorption.

BULLETIN 553

CONSUMER PACKAGES FOR MAINE McINTOSH APPLES

CHARLES H. MERCHANT,¹ EARLE E. GAVETT,² JOHN W. UNDERWOOD,³ AND
FRANK J. McDONALD⁴

INTRODUCTION

The trend in food retail merchandising is toward 100 per cent self-service, requiring the prepackaging of all products. To accomplish this objective food markets purchase as many of their items prepackaged as practical. In many cases they do not have the facilities or trained personnel to perform this prepackaging service. This situation has stimulated interest among farmers and processors to attempt to prepackage more and more farm products for the retail trade. In prepackaging McIntosh apples at the growers' packing houses, consideration must be given to consumer acceptance of the package and to a package which will give adequate protection from bruising to the apples. In the development of consumer packages attention must always be given to the cost of the containers, labor requirements for packaging and the cost of handling the prepackaged products from packaging plants to retail outlets.

During the past decade, many different kinds and types of consumer packages for apples have found their way to produce counters and display tables in retail stores. Several kinds of these packages have been accepted by consumers, but shippers have been confronted with the development of a satisfactory master container which would transport the fruit with a minimum amount of bruising. Polyethylene packages have captured the acceptance of consumers because of the complete visibility of the apples. This acceptance further augmented the problem of developing master containers that would protect the apples in polyethylene consumer packages. The McIntosh apple bruises easily in a polyethylene bag without some protection between the apples in the bag and also between the bags of apples.

Preliminary work on developing consumer packages along with

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satisfactory master containers was undertaken during the 1954-55 apple marketing season by Gavett.⁵ Results of these preliminary investigations made it possible to set up a combined study to develop consumer packages with master containers which would protect the fruit from bruising and stem punctures and also to develop packages which would have consumer acceptance.

METHOD OF STUDY

Three kinds of consumer packages were developed for testing in the 1955-56 marketing season. In developing these packages, an attempt was made to modify the jumble-pack, polyethylene package in a way that would protect the fruit from most of the bruising and still maintain almost complete visibility of the fruit. One package developed was a long narrow polyethylene bag, another contained a divider insert in a polyethylene bag and the third package had a cell partition placed in a plastic container. For a check on the amount of bruising, fibre tray-pack boxes were used. Two types of corrugated boxes were designed by two box manufacturers as master containers. Also different weights of board were used in the corrugated boxes.

Six supermarkets in the Portland market area cooperated in the sale of the experimental packages of McIntosh apples for a six week period, January 23 to March 3, 1956. A three by three rotational latin square design was used with two replicates for each of two pricing periods to measure consumer acceptance of the McIntosh apples in the packages. Each of the cooperating stores changed its display weekly.

Each of the cooperating stores was visited daily by a representative of the Maine Agricultural Experiment Station to assist the produce clerks in maintaining a uniformly well-stocked display of McIntosh apples and to record daily sales.

All apples were packaged at Highmoor Farm, one of the experiment station's farms, located about 45 miles from the Portland market area. The packages were placed in the different types of master containers and transported to Portland wholesale warehouses. From the warehouses they were transported by other trucks to retail stores as needed. A representative sample of each lot of McIntosh apples was set aside at the retail stores and examined for bruises and stem punctures. This inspection was carried on under the supervision of an official from the State Department of Agriculture.

⁵ Earle E. Gavett, "A Study of Developing Master Containers for Transporting Prepackaged Maine McIntosh Apples." Master's Thesis, University Library, June 1955.

McINTOSH APPLE SALES IN CONSUMER PACKAGES

Sales of the three consumer packages when priced at 29 cents per package of three pounds of apples, indicated a preference for the jumble-pack apples in a polyethylene bag. Of the 3,004 consumer test packages sold in the six supermarkets over a three-week period, 40.5 per cent of the apple sales were in the jumble-packed poly bag, 29.1 per cent were in a poly bag with a divider and 30.4 per cent in a poly bag with the cell inserts (table 1).

TABLE 1

Test Sales of McIntosh Apples in Six Supermarkets in Portland Market Area. Rotational latin square design method used with one week period for each treatment and two replications, January 23 to March 3, 1956

First Period—When price was 29 cents per 3 lb. package, January 23 to February 11

Store	Number of packages			Total
	Jumble	Divider	Cell	
A	111	63	119	293
B	242	171	137	550
C	320	342	269	931
D	226	75	134	435
E	162	79	96	337
F	158	143	157	458
Total	1219	873	912	3004
Average per store	203.2	145.5	152.0	500.7
Per cent of sales	40.5	29.1	30.4	100.0

Second Period—When price was 29 cents per poly-jumble and 33 cents for poly-cell and poly-divider per 3 lb. package, February 13 to March 3

Store	Number of packages			Total
	Jumble	Divider	Cell	
A	117	78	90	285
B	256	114	192	562
C	335	254	288	877
D	195	64	72	331
E	105	29	34	168
F	120	100	96	316
Total	1128	639	772	2539
Average per store	188.0	106.5	128.7	423.2
Per cent of sales	44.4	25.2	30.4	100.0

In the same six supermarkets for the second three-week period prices of the divider and cell pack polyethylene containers were increased four cents per package of three pounds of apples (from 29 to 33 cents). The price of the jumble-pack apples in the poly bag remained at 29 cents for three pounds of apples. The chief reason for increasing the price of

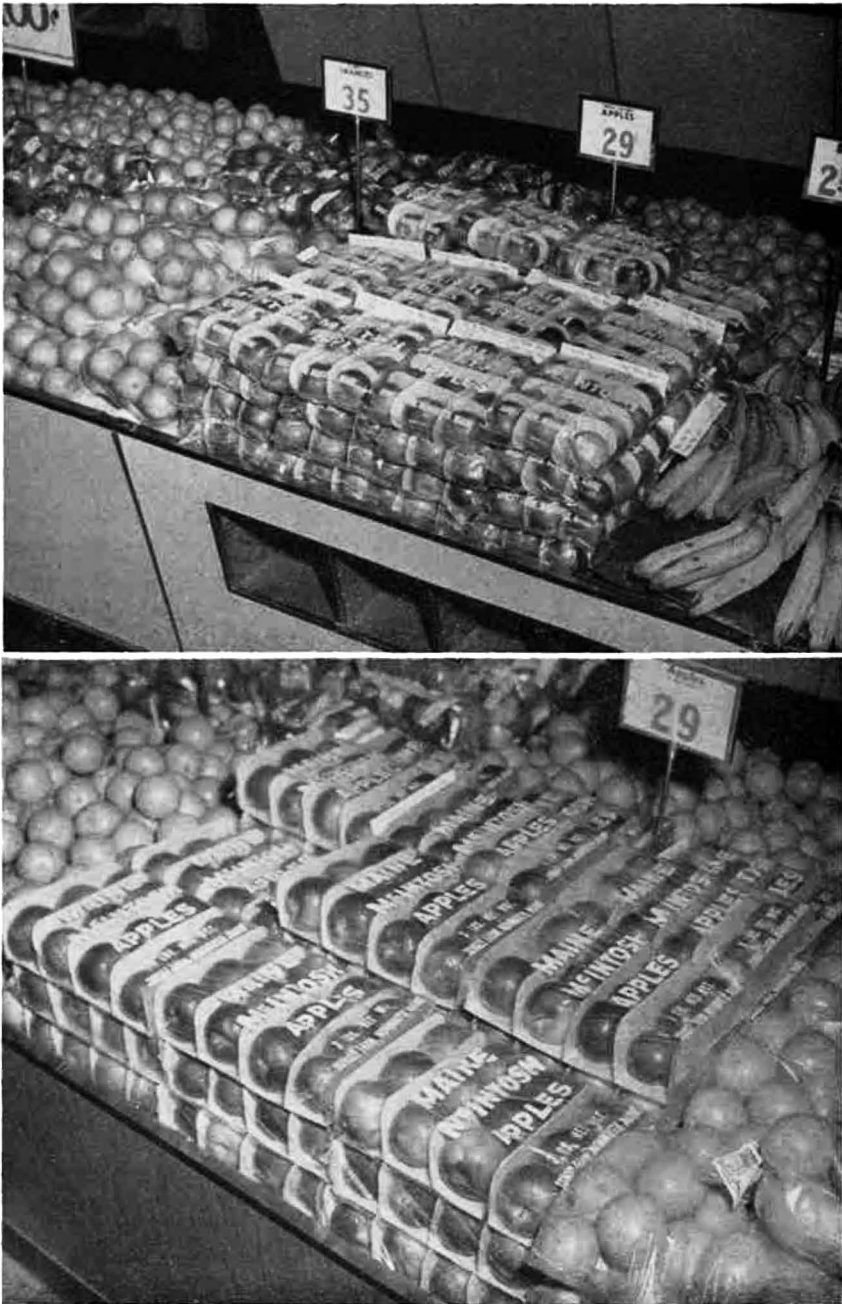


FIGURE 1. Store displays of Maine McIntosh apples in consumer packages. In the top photo the apples are packed in a cell insert, and the lower photo shows the poly bag with a divider insert. The third kind of consumer package was the elongated polyethylene bag, similar to the one which has been in use for several years.

the two modified polyethylene bags with inserts was to ascertain the willingness of consumers to pay the extra cost of the container and labor in packaging. There was no significant difference in the percentage of sales of these three consumer packages with this pricing than when all packages were priced the same. The proportion of sales in jumble-pack, polyethylene bags was 44.4 per cent, as compared with 25.2 per cent for polyethylene bags with a divider and 30.4 per cent with a cell insert in the plastic bag. The results would seem to indicate that consumers were willing to pay for the additional cost under the then current economic conditions in this market.

The apparent decline in apple sales during the last three weeks may have been caused by the lateness in the season for McIntosh apples and variations in weather conditions for shopping. Also the stores were closed on Washington's birthday, February 22, which occurred on Thursday, one of the days of normally heavy sales.

In summary, it may be stated that consumers registered their acceptance of the new types of consumer packages with a slight preference for the jumble-packed poly bag, a package quite similar to those commonly available in the market. Also, consumers were willing to pay for the additional cost of packaging with inserts to protect the fruit. All apples were practically bruise free at the time of the sale, as apples bruised in transporting or in handling were replaced in the packages before putting them on display.

McINTOSH SALES LARGEST DURING LAST THREE DAYS OF EACH WEEK

McIntosh apple sales in the test packages during the last three days of each week in the six supermarkets accounted for 75.3 per cent of the weekly sales for the first three weeks and 78.7 per cent for the last three weeks of study (table 2). These percentages of sales compare very closely with a previous study in this same market.⁶ Sales Monday through Wednesday averaged 7.7 per cent per day for the six week period with a range from 6.7 to 11.3 per cent of the weekly sales. It is interesting to note that one-third of the retail sales were made on Friday. Heavy Friday sales may be attributed in part to many of the customers receiving their weekly pay Thursday afternoon in the test area.

⁶ Charles H. Merchant, John Underwood and Frank McDonald, "Increasing Maine McIntosh Apple Sales in Retail Stores." *Maine Agricultural Experiment Station Bulletin* 534.

TABLE 2

Relative Amounts of McIntosh Apples Sold Each Day of the Week in Six Supermarkets in Portland Market Area, January 23 to March 3, 1956

A. When price was 29 cents per 3-pound package, January 23 to February 11

Day of Week	Jumble		Divider		Cell		Total	
	Packages	Per cent	Packages	Per cent	Packages	Per cent	Packages	Per cent
Monday	73	6.0	46	5.3	93	10.2	212	7.1
Tuesday	92	7.5	45	5.2	51	5.6	188	6.3
Wednesday	124	10.2	96	11.0	119	13.0	339	11.3
Thursday	215	17.6	160	18.3	140	15.3	515	17.1
Friday	415	34.1	304	34.8	256	28.2	975	32.4
Saturday	300	24.6	222	25.4	253	27.7	775	25.8
Total	1219	100.0	873	100.0	912	100.0	3004	100.0

B. When price was 29 cents per poly-jumble of 3 pounds and 33 cents for poly-cell and poly-divider, February 11 to March 3

Day of Week	Jumble		Divider		Cell		Total	
	Packages	Per cent	Packages	Per cent	Packages	Per cent	Packages	Per cent
Monday	76	6.7	40	6.2	54	7.0	170	6.7
Tuesday	96	8.5	38	5.9	53	6.9	187	7.4
Wednesday	69	6.1	49	7.6	66	8.5	184	7.2
Thursday	213	18.9	126	19.6	195	25.3	534	21.0
Friday	470	41.7	234	36.3	241	31.2	945	37.1
Saturday	204	18.1	157	24.4	163	21.1	524	20.6
Total	1128	100.0	644	100.0	772	100.0	2544	100.0

Distribution of McIntosh sales throughout the week was nearly the same for each of the three types of consumer packages. The rotational design used in this study did not measure the choice consumers might have made if they had an opportunity to select among the three types of packages. On the other hand, results indicated the acceptance of each package in the retail store. A previous study made by the Maine Agricultural Experiment Station gave some of the factors that influence McIntosh sales.⁷ Among the more important of these factors were the number and size of the displays and the comparative prices of the apples.

LESS GRADE BRUISING OF APPLES IN CONSUMER PACKAGES

In each weekly shipment of apples from Highmoor Farm to the six supermarkets, several master containers with the three types of consumer packages and boxes of tray pack apples were carefully inspected at the retail stores for bruises and stem punctures. As previously stated one of the objectives of this study was to develop both consumer packages and master containers which would protect the apples from excessive injury

⁷ See footnote 6.

in transit from country packing houses to retail stores via wholesale warehouses. The tray pack was used largely as a check since this container has been generally accepted by growers and the trade as one of the better methods of handling quality McIntosh apples. The McIntosh apple is not only a variety that bruises easily but the 1955 crop was well mature when harvested. The apples used in this study had a pressure test of only about eight pounds. This extreme maturity should enhance the usefulness of the results of this study.

The bruises were classified as major and minor injury. The major bruises would lower the grade of apples while the minor bruises merely lowered the general appearance of the fruit. Likewise, stem punctures were indicated as major and minor injury. The major stem punctures definitely were grade injury while the minor stem punctures were slight pricks in the skin and flesh of the apples.

It was found that the three consumer packages arrived at the retail stores with fewer grade and minor bruises than apples in the tray pack (table 3). Stem punctures were most frequent in the jumble-pack poly bags. This situation had been observed in previous work⁸ and was expected to be serious in this study. Apples in a jumble-pack have apple-to-apple contact resulting in more bruises and stem punctures than in the other two packages. In contrast, the cell-pack apples had very few stem punctures. In fact there was a smaller percentage of stem punctures found in the cell pack than in the tray pack apples. The occurrence of stem punctures in the divider pack was intermediate between that in the cell pack and that of the jumble pack. The total number of stem punctures in the divider pack was not a serious factor in the use of this kind of container (table 3).

TABLE 3

Comparison of Bruises and Stem Punctures Occurring to McIntosh Apples in Consumer Packages and in Tray Pack Containers Transported from Highmoor Farm to Six Supermarkets via Wholesale Warehouses in Portland Market Area, January 23 to March 3, 1956

Package	No. Apples	Bruises				Stem Punctures			
		Major		Minor		Major		Minor	
		No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Jumble	4896	187	3.8	606	12.4	41	.8	54	1.1
Divider	3888	73	1.9	520	13.5	5	.1	13	.3
Cell	5040	311	6.2	805	16.0	2	*	1	*
Tray	2000	133	6.6	649	32.5	—	—	3	.2

* Less than .05 per cent.

⁸ See footnote 5.

The location of the bruises and stem punctures found on the apples in the three consumer packages and in the tray containers was usually on the cheek of the apples (table 4). Injury to either the stem or calyx end of apples was unimportant.

TABLE 4
Location of Bruises and Stem Punctures Occurring to McIntosh Apples, in Consumer Packages and in Tray Pack Container, Transported from Highmoor Farm to Six Supermarkets via Wholesale Warehouses in Portland Market Area, January 23 to March 3, 1956

Package	No. Apples	Bruises				Stem Punctures			
		On Cheek		Other Locations		On Cheek		Other Locations	
		No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Jumble	4896	785	99.0	8	1.0	95	100.0	—	—
Divider	3888	592	99.8	1	.2	18	100.0	—	—
Cell	5040	1116	100.0	—	—	4	100.0	—	—
Tray	2000	775	99.1	7	.9	3	100.0	—	—

SLIGHTLY MORE BRUISING IN BOTTOM LAYER OF MASTER CONTAINERS

Analyses were made to determine the location of the bruised apples in the master containers and in individual packages. Apples in packages in the bottom layer of master containers showed slightly more major and minor bruises for the three kinds of consumer packages than the upper two layers (table 5). The middle layer of packages had the least amount of bruised fruit. Of course, this middle layer had some protection from both the top and bottom layers. It seems imperative that the bottom and top of master containers should be well constructed. Further, the container needs to be of the proper size to give a tight and compact package. Slack containers or containers with excess bulge result in much bruising of the fruit.

TABLE 5
Amount of Bruising Occurring to McIntosh Apples, in Consumer Packages in Different Layers in Master Containers, Transported from Highmoor Farm to Six Supermarkets via Wholesale Warehouses in Portland Market Area, January 23 to March 3, 1956

Layer	Jumble				Divider				Cell			
	Bruising		Stem Punctures		Bruising		Stem Punctures		Bruising		Stem Punctures	
	Major	Minor	Major	Minor	Major	Minor	Major	Minor	Major	Minor	Major	Minor
	(per cent)				(per cent)				(per cent)			
Top	2.0	12.6	1.1	1.5	1.1	14.0	.1	.5	3.0	16.2	.1	—
Middle	.7	11.7	.7	1.1	2.1	11.4	.1	.4	2.9	14.1	.1	—
Bottom	8.8	13.1	.6	.7	2.5	14.7	.1	.1	12.6	17.6	—	.1
Average	3.8	12.4	.8	1.1	1.9	13.5	.1	.3	6.2	16.0	.1	*

*Less than .05 per cent.



FIGURE 2. Placing consumer packages in master container. At the left the modified jumble-pack poly bag, in the center the poly bag with divider insert and at the right the poly bag with the cell insert.



FIGURE 3. Method used to package apples in polyethylene bags with dividers and inserts. It would be a simple procedure to fill the inserts or dividers mechanically and to slip the poly bag over the filled units.

In tray pack fruit the apples in the bottom layer received more bruising than apples in the other layers. Unlike layers of consumer packages in a master container, the amount of bruising was the least in the topmost layer of tray-pack fruit and increased rather consistently with each succeeding layer. One of the reasons for increased bruising in succeeding lower layers is that some of the weight of the upper layers rests on the apples below. The design of the master container and the dividers for the consumer packages kept most of the weight of the upper layers of apples from being delivered to lower layers (table 6).

TABLE 6

Comparison of Bruising and Stem Punctures in Five Layers of Tray Pack Containers of McIntosh Apples, Transported from Highmoor Farm to Six Supermarkets via Wholesale Warehouses in Portland Market Area, January 23 to March 3, 1956

Tray	Bruises				Stem Punctures			
	Major	Per cent	Minor	Per cent	Major	Per cent	Minor	Per cent
1	6	1.5	95	23.8	—	—	—	—
2	10	2.5	138	34.6	—	—	1	.2
3	16	4.0	132	33.1	—	—	2	.5
4	35	8.8	141	35.3	—	—	—	—
5	66	16.6	143	36.0	—	—	—	—
Total or Average	133	6.6	649	32.5	—	—	3	.2

APPLES IN CENTER OF CONSUMER PACKAGES RECEIVED MOST BRUISES

In a sample of each of the three kinds of consumer packages each apple was examined for major and minor injuries. In the polyethylene bag with a cell insert, the center apples (fig. 4) showed nearly twice the amount of bruising as other apples in the package. The height of the corrugated cells needed to be increased about $\frac{1}{8}$ -inch for $2\frac{3}{4}$ -inch apples for their adequate protection. Apparently with the present insert the center apples in the package received more contact with apples in other packages and thus received more bruising. Also it should be noted that the four apples in the bottom of the cell package received fewer bruises than other apples in the package.

There were some variations in the amount of injury among the apples in polyethylene bags with the divider partition. However, no one apple in the package received much less or much more damage than other apples. Again apples in the bottom of the package showed somewhat less bruising. Also, apples in the top of the package showed more grade damage than apples in the center of the container. In contrast to

the apples in the cell packages, more stem punctures were evident in this type of package.

Apples in the top and bottom of the jumble polyethylene bag showed less bruising than apples in the center of the container. This situation resulted from more apple to apple contact. There were considerably more stem punctures occurring in this package than in the other two consumer packages.

TABLE 7

Location of Bruises and Stem Punctures on McIntosh Apples Occurring in Three Kinds of Consumer Packages Transported from Highmoor Farm to Six Supermarkets via Wholesale Warehouses in Portland Market Area, January 23 to March 3, 1956

Position of Apple	Cell Packages				Divider Packages				Jumble Packages			
	Bruises		Stem Punctures		Bruises		Stem Punctures		Bruises		Stem Punctures	
	Major	Minor	Major	Minor	Major	Minor	Major	Minor	Major	Minor	Major	Minor
	(Per cent damaged)				(Per cent damaged)				(Per cent damaged)			
1	4.5	18.3	.2	—	3.7	17.0	.3	.6	.5	10.5	.7	.7
2	5.7	19.3	—	—	3.4	16.4	—	—	2.2	14.5	1.5	1.0
3	4.8	13.1	—	—	1.2	16.7	.3	—	3.4	16.4	.5	.5
4	8.6	17.6	—	—	1.2	13.6	—	.9	8.6	18.4	2.0	1.2
5	15.2	27.1	—	—	1.9	14.8	—	—	5.9	17.6	.5	2.2
6	5.2	15.0	—	.2	1.9	13.6	—	.6	6.6	13.5	1.0	1.5
7	5.2	16.9	—	—	3.1	16.0	—	.6	4.7	9.1	1.5	.5
8	9.3	17.9	—	—	1.2	8.6	.3	.3	4.7	11.3	.7	2.2
9	4.8	12.4	—	—	2.2	16.7	—	.3	3.4	11.3	.5	1.0
10	3.3	9.3	.2	—	1.2	9.6	.3	—	3.2	9.8	.5	1.5
11	3.8	11.4	—	—	.3	7.4	—	.3	2.2	12.5	.7	1.0
12	3.6	13.3	—	.2	1.2	10.2	.3	.3	.5	3.7	—	—
Average	6.2	16.0	.1	*	1.9	13.5	.1	.3	3.8	12.4	.8	1.1

* Less than .05 per cent.

As previously stated the tray pack was used chiefly as a check on the amount of bruising occurring in consumer packages. It is interesting to observe the rather wide variations in the amounts of bruising among the individual apples (table 8). There are many factors which may have been responsible for these wide variations in the amount of bruising on individual apples.

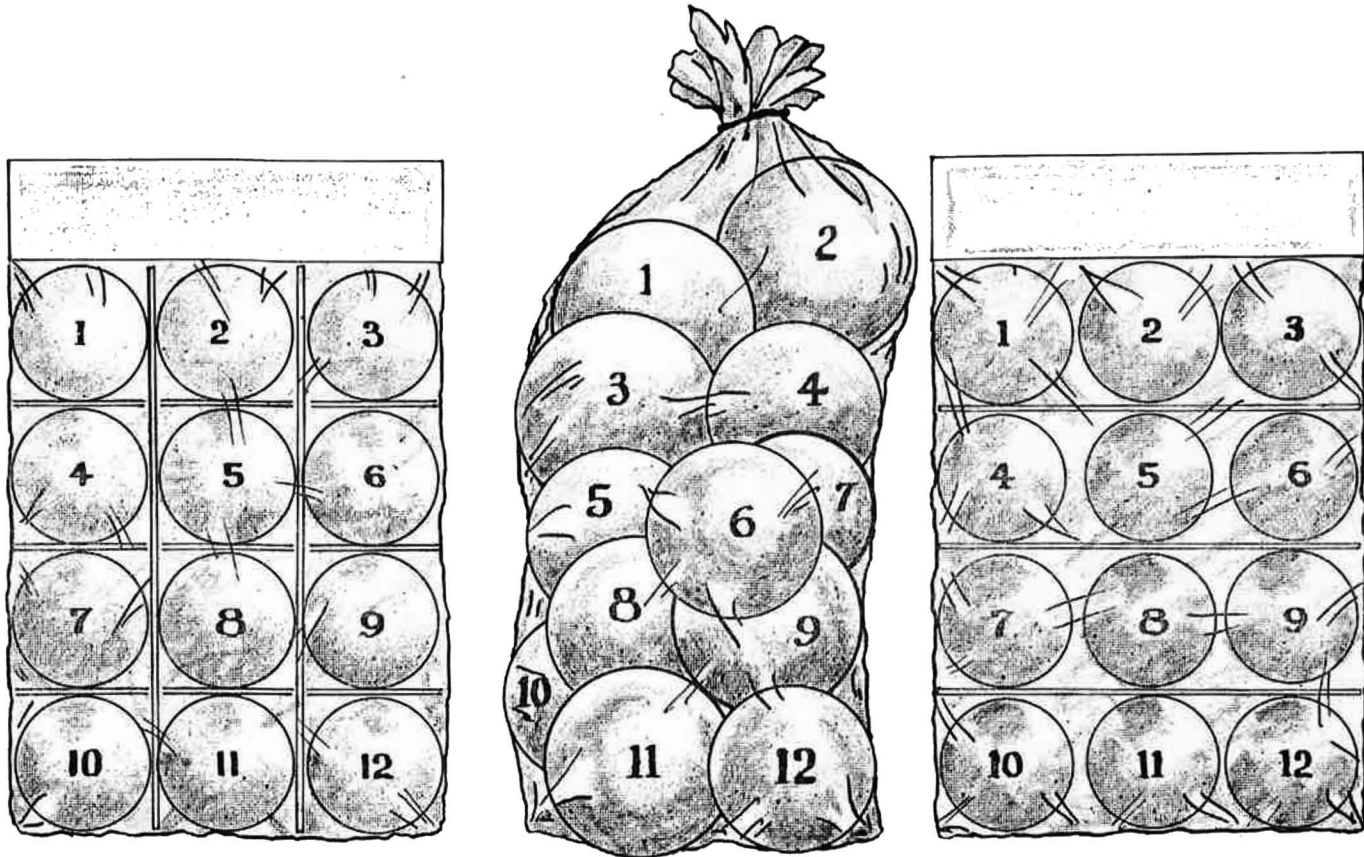


FIGURE 4. Cell package at the left, poly jumble-pack in the center and the divider package at the right showing the positions of the apples in consumer packages.

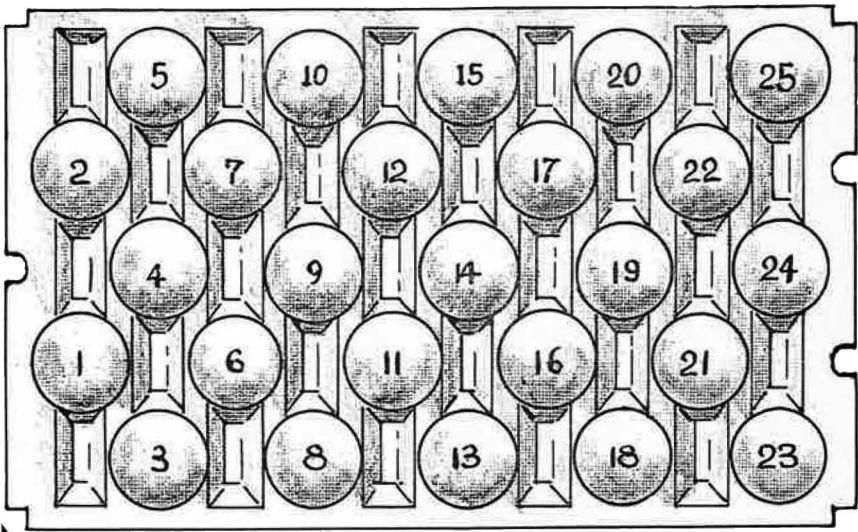
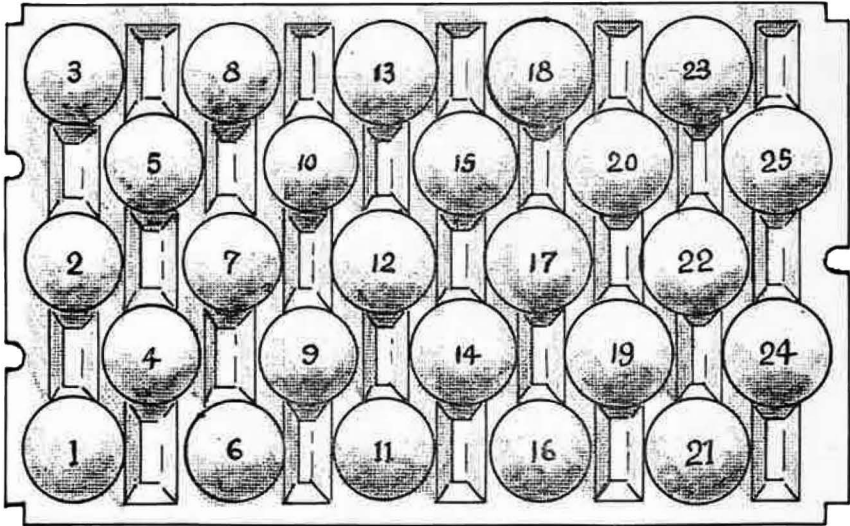


FIGURE 5. Apples in odd and even-numbered trays in Friday tray box of 125 apples. Trays 1, 3, and 5 are illustrated by the upper drawing, and trays 2 and 4 by the lower drawing.

TABLE 8

Location of the Bruises and Stem Puncture on McIntosh Apples in Tray Pack Containers Transported to Six Supermarkets via Wholesale Warehouses in Portland Market Area, January 23 to March 3, 1956 (Sixteen Friday Pack Trays)

Position of apple	Trays, No. 1, 3 and 5			Trays, No. 2 and 4		
	Grade	Minor Injury	Total	Grade	Minor Injury	Total
	(Per cent damaged)					
1	10.4	43.7	54.1	—	46.9	46.9
2	10.4	33.3	43.7	—	31.2	31.2
3	2.1	35.4	37.5	9.4	21.9	31.3
4	4.2	37.5	41.7	9.4	37.5	46.9
5	4.2	35.4	39.6	12.5	28.1	40.6
6	6.2	27.1	33.3	6.2	28.1	34.3
7	12.5	27.1	39.6	6.2	37.5	43.7
8	10.4	22.9	33.3	3.1	46.9	50.0
9	2.1	37.5	39.6	3.1	46.9	50.0
10	6.2	35.4	41.6	3.1	28.1	31.2
11	8.3	29.2	37.5	6.2	43.8	50.0
12	6.2	37.5	43.7	3.1	34.4	37.5
13	4.2	27.1	31.3	3.1	34.4	37.5
14	6.2	31.2	37.4	6.2	43.8	50.0
15	—	27.1	27.1	6.2	40.6	46.8
16	6.2	35.4	41.6	6.2	18.8	25.0
17	14.6	31.2	45.8	6.2	37.5	43.7
18	10.4	20.8	31.2	9.4	34.4	43.8
19	2.1	39.6	41.7	3.1	37.5	40.6
20	12.5	27.1	39.6	3.1	46.9	50.0
21	6.7	33.3	40.0	10.0	40.0	50.0
22	12.5	37.5	50.0	9.4	28.1	37.5
23	4.2	35.4	39.6	6.2	21.9	28.1
24	12.8	17.0	29.8	6.2	34.4	40.6
25	8.5	12.8	21.3	3.1	28.1	31.2

STRONGER MASTER CONTAINERS GAVE BETTER RESULTS

Specially designed corrugated paper boxes of two different strengths were used as master containers. One had a test strength of 200 pounds and the other 275 pounds. Apples in the 275-pound test master containers showed considerably less bruising and especially less grade damage than fruit in the lighter containers. The differences were 1.6 per cent in major bruises and 1.2 per cent in minor injuries. It should be recalled that the apples used in this study were well matured and these differences might not be as large with more firm apples.

A new container has been developed with an asphalt laminated layer. This container was of 275 pound test. The container was included to see if it would resist the absorption of moisture and remain more rigid than the ordinary corrugated master container. In this way the container might afford more protection to the fruit. However the limited number of containers used showed no evidence of giving more protection to the apple. In fact, there was somewhat more bruising of the fruit shipped in this package than in the ordinary 275 pound test cor-

rugated master container. However, further work needs to be conducted before any reliable conclusions may be drawn (table 9).

TABLE 9

Injury Occurring to McIntosh Apples in Three Kinds of Consumer Packages Transported in Master Containers of Two Weight Tests from Highmoor Farm to Six Supermarkets via Wholesale Warehouses in Portland Market Area, January 23 to March 3, 1956

Master Container and Consumer Package	No. of Masters	Per cent of Injury			
		Bruises		Stem Punctures	
		Major	Minor	Major	Minor
A 200#					
Jumble	12	3.9	14.1	1.3	.9
Divider	6	3.1	13.3	.1	.8
Cell	13	5.2	14.5	—	—
Total or Average	31	4.3	14.1	.5	.5
B 200#					
Jumble	9	5.1	12.6	.2	1.3
Divider	11	1.3	14.1	.3	.1
Cell	10	9.5	17.9	.1	.1
Total or Average	30	5.2	14.9	.2	.5
C 275#					
Jumble	2	1.7	11.1	—	1.0
Divider	3	1.6	10.2	—	.5
Cell	3	1.6	16.0	—	—
Total or Average	8	1.6	12.6	—	.4
D 275# Asphalt Laminated					
Jumble	11	3.1	10.8	.8	1.1
Divider	6	2.1	14.8	—	.2
Cell	9	5.3	16.0	—	—
Total or Average	26	3.6	13.5	.3	.5