

A REPORT
of an Experimental Carload of Fresh Vegetables
Unloaded in Columbus, Ohio
September 18, 1947

Chas. W. Hauck
and
John J. Crawford

Department of Rural Economics and Rural Sociology
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Table of Contents

	Page
Introduction	1
Contents and Loading	2
Refrigeration	4
Condition on Arrival	4
Consumer Acceptance	5
Salable Life	6
Conclusions	7

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Introduction

This report describes an experimental carlot of six commercial fresh vegetables shipped September 9, 1947, from Molus Station in the Salinas Valley, California to Columbus, Ohio, arriving at destination September 18. Part of the contents of the car had been prepackaged, 1/ part was in conventional form, all packed in special shipping containers. The entire carlot was reported by the shipper to have been precooled, washed, dried and subjected to germicidal and fungicidal treatment to retard molds, decay and other forms of deterioration.

This experiment was initiated by the research department of the Western Growers Association, whose membership includes many of the leading producers and shippers of fresh vegetables in California and Arizona.

The shipment reported herein was one of five test carlots, all said to be of a similar nature, rolled in September from the experimental packing house of the Association and destined to large wholesale and chain store distributors in Boston, Cincinnati, Columbus, Detroit and Minneapolis. Consignee of the car sent to Columbus was the Great Atlantic and Pacific Tea Company.

The Ohio Agricultural Experiment Station (Department of Rural Economics and Rural Sociology) was invited to observe the car and its contents upon arrival, and to conduct such other tests thereafter as it deemed advisable. The Experiment Station had no part in planning or directing the investigation. Interest in the shipment was attested by the presence of 25 observers at the unloading, representing 19 business organizations and public agencies.

Purpose of this test shipment was to throw some light on the following question; Can fresh vegetables, prepackaged at points of production, be

1/ "Prepackaging" defines the process whereby fresh (unprocessed) fruits and vegetables, prior to offering at retail, are subjected to whatever washing and trimming may be necessary to prepare them partially or completely for kitchen or table use, and then are transformed, either with or without precooling and refrigeration, into self-service items by packaging in pre-priced, labeled, closed, usually transparent, consumer units. The term is intended to distinguish this type of packaging (a trimmed head of cauliflower, a bunch or two of topped carrots, a pound of snap beans or tomatoes, and the like) from the familiar and conventional bulk, untrimmed items packed in wholesale shipping containers.

delivered safely to distant users? Stated in more specific terms, if these products when harvested are readied for kitchen or table use by removing inedible tops, husks, stems, leaves, etc. usually left for protection in transit and distribution, and then are packaged in transparent consumer units immediately, how long will they remain acceptable to consumers? Is it feasible to enclose unprocessed perishable foods in sealed containers where the foods are grown, as much as two weeks before they can be delivered to the ultimate user? Is there any combination of treatments and handling practices that can insure retention of quality, freshness and peak acceptability long enough to permit transportation and distribution in this form from the west coast to major Eastern consuming markets?

Pioneers in the prepackaging field do not agree on an answer. Some are of the opinion that full advantages of this merchandising innovation will not be enjoyed unless and until all prepackaging is done at the source, discarding all inedible and non-essential parts before shipment, thus saving on containers, shipping space and weight, freight and drayage, icing charges, handling labor and expense, permitting beneficial use of trimmings on the land, and simplifying problems and reducing costs of garbage disposal in populous consuming areas. Others hold to the view that necessity for a "last look" to insure freshness on the retail counter will continue to require all prepackaging to be done in the form of re-packing in terminal markets, converting conventional wholesale shipments into closed, labeled consumer units just before delivery to retailers. Still others take a middle position, pointing out (1) that shipping point prepackaging in consumer units has been going on commercially for a long time with such products as potatoes in paper bags, apples, dry onions and citrus fruits in mesh bags, berries in wood and paper cups, mushrooms in paper boxes, cranberries in transparent film bags, and others, (2) that increasing numbers of these containers have been showing up in the channels of trade enclosed and more or less hermetically sealed in transparent films of one sort or another, (3) that as technological improvements take place and better handling facilities and practices are adopted there is good reason to expect extension of sealed prepackaging at points of origin to more perishable items, and (4) that in any case the job is likely to be done in part at both ends of the line for some time.

Contents and Loading

The shipment consisted of broccoli, brussels sprouts, carrots, cauliflower, celery and head lettuce, invoiced as follows:

	<u>Prepackaged</u> (crates)	<u>Not prepackaged</u> (crates)	<u>Total</u> (crates)
Broccoli	-	94	94
Brussels sprouts	2	-	2
Carrots, bunched	38	-	38
Cauliflower	3	50	53
Celery	55	112	167
Lettuce, head	<u>48</u>	<u>258</u>	<u>306</u>
TOTAL	146	514	660

It will be observed that about 22 percent of the load was in prepackaged form. The two types of merchandise were distributed throughout the load in various positions and levels in a manner to minimize any possible advantage of location in the car.

All the produce was packed in rectangular, slatted wood crates with outside dimensions 9 1/2 x 16 x 19 inches, permitting no bulge. Broccoli, carrots, celery, and lettuce were packed in nailed crates; brussels sprouts and cauliflower in cleated wire-bound crates, each containing two fibreboard trays. These newly designed crates had slightly more than one-half the capacity of the standard western vegetable crate, whose outer dimensions are 13 x 18 x 21 5/8 inches.

Contents of these new style shipping containers were as follows:

	<u>Number of Units per crate</u>	
	<u>Prepackaged</u>	<u>Not prepackaged</u>
Broccoli	-	24 bunches
Brussels sprouts	48 bags	-
Carrots, bunched	48 bags	-
Cauliflower	48 bags	24 heads
Celery	24 stalks	24 stalks
Lettuce, head	24 heads	24 heads

Broccoli was shipped in the usual type bunches weighing about one pound each. None was wrapped or prepackaged.

Brussels sprouts were all prepackaged in transparent bags -- some Pliofilm, some Cellophane -- containing about one half pound each.

Carrots were all topped -- tops clipped, leaving only short stems remaining attached to the carrots -- and prepackaged in Pliofilm bags holding about two-thirds of a pound each, with a paper label attached at the top.

Cauliflower, prepackaged, was segmented and sealed in Pliofilm bags, holding about one half pound each. Heads not prepackaged were trimmed to remove practically all leaves and stems, and were packed one layer deep in fibreboard trays, each tray covered with a sheet of Cellophane.

Celery, prepackaged, tops slightly trimmed, was packed in transparent bags -- some Pliofilm, some Cellophane -- a single stalk to a bag. Stalks not prepackaged were similarly trimmed, packed in layers.

Lettuce was trimmed somewhat more closely than the usual conventional shipments. Heads prepackaged were sealed separately in Pliofilm. Heads not prepackaged were covered with one sheet of Cellophane in each crate.

This type of packaging permitted shipment of more edible produce to a given space or weight than when packed and loaded in conventional fashion. Gains were apparent in both the prepackaged produce and that not prepackaged, due to elimination of crate ice, use of less bulky containers, and discarding of excess tops and leaves that otherwise would have been shipped. Potential carloads, said by the shipper to be 770 new style crates if loaded in Preco fan-cooled cars, may be compared with usual carloads in conventional shipping containers in standard refrigerator cars.

	Usual carload			Potential carload in new style crates		
	shipping containers per car	Food units per shipping container	per car	shipping containers per car	Food units per shipping container	per car
Broccoli	464 crates	40 lbs.	18560	770	24 lbs.	18480
Brussels sprouts	300 drums	50 lbs.	15000	770	24 lbs.	18480
Carrots, bunched	366 crates	72 bunches	26352	770	48 bunches	36960
Cauliflower	512 crates	12 heads	6144	770	24 heads	18480
Celery	448 crates	30 stalks	13440	770	24 stalks	18480
Lettuce, head	312 crates	48 heads	14976	770	24 heads	18480

Thus it appears that in terms of actual food transported, a carload when shipped in these new style crates is roughly equivalent to 1.0 conventional carload of broccoli, 1.2 cars of brussels sprouts, 1.4 cars of carrots, 3.0 cars of cauliflower, 1.4 cars of celery, and 1.2 cars of lettuce.

Refrigeration

No crate ice or top icing was used. Shipment was made in a Preco fan-cooled refrigerator car using bunker ice only, fans in "on" position in transit. The lading was held in place securely by a special bracing which allowed free circulation of air through the load.

Recording thermometers (Ryan thermographs) were located at three points in the load, and one was placed beneath the car to record outside air temperatures. Continuous records in transit were kept at all positions.

Temperatures within the car as shown by these thermometers were unusually favorable upon arrival, and had fluctuated only slightly en route. Upon arrival, air temperatures were at the top, quarter length of the car, approximately 43° F, at the middle quarter length 36° F, and at the bottom quarter length 36° F. In 9 days in transit, temperatures had fluctuated between 44° and 34° at the top, between 43° and 32° at the middle, and between 39° and 33° at the bottom. Air temperatures outside the car during these 9 days had varied between 95° and 35°.

Condition on Arrival

The lading was carefully stowed and skillfully braced. No shifting or breakage was apparent. Containers and contents were practically free from mechanical damage.

Condition and appearance of the prepackaged vegetables for the most part were excellent upon arrival. The prepackaged produce generally was fresh and crisp, bright and attractive in color, somewhat superior in these respects to that not prepackaged. Segmented cauliflower in Pliofilm bags, however, though attractive in appearance and texture, gave off an unpleasant odor when opened. This concentration of the natural odor of the vegetable within the closed packages disappeared rapidly upon exposure in free air, without noticeable effect on the flavor of the cauliflower.

Produce not prepackaged generally was in very good condition. Some celery in the center of the car next one of the doors was slightly wilted, flaccid and dull in appearance.

Consumer Acceptance

Produce from this car was handled by the receiver in the usual commercial manner, without special care or speed. All the prepackaged vegetables (except a few crates withdrawn at random for continuous observation) were distributed in the original shipping containers by motor trucks to the 10 Columbus supermarkets and some out of town stores of the company on Friday morning, the day following unloading of the car. Produce not prepackaged by the shipper was channeled through the company's prepackaging ^{2/} operation in its Columbus warehouse, where the vegetables were immediately trimmed, sealed in transparent consumer units, labeled and shipped to these stores on Friday and Saturday following unloading. Thus all the produce in this shipment reached consumers in prepackaged form.

Sales in six representative stores in Columbus were kept under observation during these two days, Friday and Saturday. In all six stores patrons were familiar with prepackaged fruits and vegetables, the produce departments in these stores having been converted to refrigerated, prepackaged, self-service for periods of 2 years or longer.

It was not possible to set up sales displays of the items from the experimental shipment in an ideal manner to permit sales comparisons with equivalent quantities of the same items from standard stock. This shipment supplanted completely the customary supplies of these commodities in some of the company's stores on those days. In some cases where identical items were carried over from earlier receipts it was possible in a limited way to offer the experimental items in competition with standard goods. All sales were at standard prices except when reduced for quick sale.

The small quantity of brussels sprouts - 2 crates - in this shipment permitted no sales observations. Of the five remaining items, four met with good acceptance by consumers.

Broccoli was poorly received, though the quality was good - unseasonably hot weather in Columbus before, during and after these observations was accompanied by sluggish sales of broccoli in all of the company's stores. Two thirds of Friday's stock was carried over to Saturday, and despite a sharp price reduction on three fourths of the Saturday supplies, about 10 percent of the entire amount invoiced to the test stores remained unsold at the close of business Saturday.

Carrots prepackaged in California outsold carrots repacked by the cooperating chain store company from its standard stock. On Friday when both types were available, carrots from this shipment accounted for more than 70 percent of the carrot sales.

Cauliflower sold readily. Mostly segmented and repacked by the chain store company after arrival, it was attractive in appearance. Some packages in one store were reduced in price for quick sale late Saturday.

Celery prepackaged at shipping point was the only celery supplied to the stores on Friday and was offered in competition with standard top quality

^{2/} This terminal market operation will be referred to herein as "repacking" to distinguish it from prepackaging at the point of origin. The finished produce in either case was trimmed and sealed in transparent films.

celery repacked by the chain store company and carried over in the store from earlier receipts. The former outsold the latter 6 to 1. Saturday's receipts consisted of celery from this car that had been repacked by the company after arrival. Quality and appearance were excellent. This made up the bulk of the day's offerings of celery as only small amounts of the other packages were carried over from the previous day. Celery sales on Saturday were gratifying.

Lettuce from this car went to the stores on Friday in both forms -- prepackaged at shipping point and repacked by the chain store company after arrival. On Saturday the stores received the latter only. Trimming of these latter heads in the chain store repacking operation was unnecessarily severe, and reduced the size of the heads noticeably. Heads prepackaged at shipping point showed some superficial bruising and discoloration. Yet they sold readily without reconditioning due probably to their large size and firmness. The fresher appearing but smaller repacked heads also sold well after the larger original heads were gone.

Salable Life

Obviously arrival in good condition at rail destination is not sufficient insurance that vegetables handled in this manner will be deliverable to consumers in good condition through customary retail channels. How long will they remain acceptable after unloading from a refrigerator car?

In an effort to ascertain the salable life or "shelf-life" of these commodities after arrival 5 small representative lots of 4 items from this car were held for observation in the open display compartment of a standard Hussman refrigerated, open-top retail display case in one of the Ohio State University laboratories. Temperatures in the case were normal for retail operation. These test lots were as follows:

- (1) Broccoli, repacked after arrival
- (2) Cauliflower, repacked after arrival
- (3) Celery, prepackaged at shipping point
- (4) Lettuce, prepackaged at shipping point
- (5) Lettuce, repacked after arrival.

Broccoli in Lot 1 showed a small degree of flowering when placed in the experimental display case. No apparent deterioration took place in 4 days. By the fifth day the samples showed further flowering and other evidences of aging. Though this broccoli had not become completely unsalable at this stage, it could have been sold only at reduced prices. The samples were discarded.

Cauliflower in Lot 2 remained in salable condition without necessity for price reduction for 4 days. Discoloration of the cut surfaces became apparent on the fifth day, after which the samples were discarded.

Celery in Lot 3, both in Pliofilm and Cellophane, remained in excellent condition for 15 days. No discoloration or other evidence of deterioration was apparent by that time. The samples were examined and found to be of

first quality. The packages having been opened, the samples were discarded. Pliofilm became slightly clouded and Cellophane developed a crackled appearance after a few days, reducing in both cases the transparency of the films, but both seemed equally effective in retaining the fresh, crisp, bright appearance of the celery.

Lettuce in Lot 4 showed slight external bruising and rusting or discoloration of the cut stem when placed in the refrigerated case. Little or no change was apparent for 7 days. On the eighth day discoloration was so pronounced as to render the lettuce unsalable except at reduced prices. The packages were then opened and the heads reconditioned. It was found that appearance and salability of the lettuce could be restored by removal of only the outer leaves. The samples then were discarded.

Lettuce in Lot 5 retained top quality appearance for 13 days. Drying of the outer leaves became apparent on the fourteenth day and the packages were opened. Slight reconditioning restored the heads to No. 1 condition. The samples were discarded.

conclusions

The single test shipment reported herein gave evidence of having been handled with unusual care and better-than-average refrigeration, favorable conditions that are both commercially desirable and commercially feasible. Results can be considered conclusive only if confirmed by further experience or replications of the experiment. More enlightening conclusions would have been possible had untreated conventional lots of each item, packed in standard shipping containers, been included in the shipment as checks, and if those planning the investigation had foreseen the need for careful arrangements for controlled retail sales comparisons.

Nonetheless this shipment did tend to show that:

- (1) dry packed vegetables may be expected to remain in good condition on a 10 day haul (and probably longer) in a fan-cooled refrigerator car;
- (2) transit damage arising from careless or improper stowing and bracing can be completely eliminated;
- (3) newly designed rectangular (no bulge) shipping containers may be had which permit economies in the shipment of fresh vegetables, reduce mechanical damage to the produce and increase ease and speed of handling;
- (4) certain leafy vegetables and root crops, if conditions are favorable, can be successfully prepackaged at points of production and be delivered in good condition to retailers 10 days distant (or farther) for sale without further processing;
- (5) such products if displayed under refrigeration by the retailer can be expected to possess at least a normal "shelf-life" and to enjoy good consumer acceptance;
- (6) prepackaging at shipping points may reduce wastes caused by excessive trimming and reconditioning by retailers and minimize reduction of sizes of items such as head lettuce or celery;

- (7) transparent packaging films may have been perfected for some products, but not for all (as note the unpleasant odor of prepackaged cauliflower and discoloration of head lettuce on arrival); and
- (8) fungicidal and germicidal treatments, (said to have been applied to the produce in this shipment but on which no data are available for this report) suggest a promising method of prolonging the salable life of fresh vegetables.

The implications of this and related studies are far reaching -- of great significance to agriculture, foods and related industries, and consumers. The field merits more research.

Experience with this shipment further emphasizes that research calls for planning and direction by persons skilled in research methods, and close teamwork by all the parties involved. It is likely that with more thorough planning and coordination, more dependable information dealing with a greater variety of questions might have been revealed by this experimental shipment, and at little, perhaps no greater cost.

Contributions to prepackaging investigations may be made at appropriate points by shippers, receivers, commercial suppliers of packing materials and equipment, transportation agencies, the Agricultural Experiment Stations in the States of origin and destination, the United States Department of Agriculture, and perhaps others. Much may be accomplished by all these, working together.

In an experiment involving a problem of such deep public significance, it would seem desirable to make use of all available talents and facilities that are pertinent to the inquiry, and to insist upon thorough integration and direction of these forces by a competent research agency.
