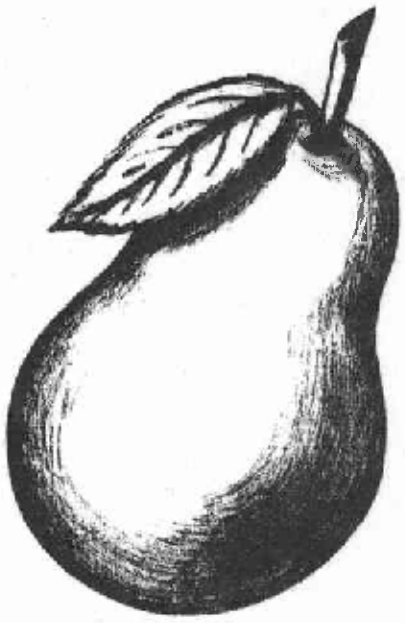
Experimental Packaging and Consumer Acceptance of Individually Wrapped Pears

SPECIAL REPORT 181
NOVEMBER 1964

Agricultural Experiment Station
Oregon State University
Corvallis



CONTENTS

AUTHORS: R. D. Langmo is Industrial Engineer and Associate Professor, Department of Agricultural Economics, Oregon State University, and R. D. Groder is Extension Fruit and Vegetable Marketing Specialist, Oregon State University.

EXPERIMENTAL PACKAGING AND CONSUMER ACCEPTANCE OF PEARS IN INDIVIDUAL POLYETHYLENE BAGS

Preface

Packaging pears in individual plastic film bags is a departure from the standard method of wrapping. Some effects of this trial packaging method upon physical condition of the fruit and the reactions of buyers are described in this report.

The Department of Agricultural Economics supervised work on the physiological response of the fruit reported in the first section of this publication. Trade and consumer reaction discussed in the second section was determined by the Oregon Extension Service. Though the two sections are independently authored, they are interdependent and prerequisite to further steps in developing a single-pack method. In comparing consumer reaction to single-pack and conventional pack pears, the Extension Service took the opportunity to observe other consumer characteristics. Although not directly related to the single-pack evaluation, they have been put to use in a subsequent pear sales promotional program and are included in this report.

Fruit quantities and experimental procedures in this study were limited. However, the complete processing and movement of the pears from packing through retailing required extensive aid from many sources.

Following the stimulation of the single-pack idea by Forrest Baker, Coordinator of the Transportation Research Institute, other university facilities and staff essential to the study were involved. Contributors included Dr. Elmer Hansen, Department of Horticulture, Associate Professor Lloyd Frazier, Department of Production Technology, Oregon State University, and Mrs. Helen Goodrich, Area Home Economist, University of California, Agricultural Extension Service.

Industry approval and guidance in the project was provided through the Oregon-Washington-California Pear Bureau. Interest, cooperation and sharing of costs were extended by many private firms. Included were two suppliers of plastic film, a packing plant, two packaging equipment builders, a truck freight line, and a number of stores within a supermarket system. The Hood River office of the Oregon State Employment Service procured workers to assist in packing the experimental fruit.

I. EXPERIMENTAL PACKAGING OF D'ANJOU PEARS

R. D. Langmo

Introduction

Changes in shipping containers and retail packages for fruit and vegetables have been increasing in recent years. Innovations in packaging seek to provide more effective handling and a better quality product for the consumer.

Repackaging of apples at terminal distribution centers and retail stores is a common practice. Various containers such as film bags, paper tote bags, fiberboard trays, and baskets are employed. Repackaging in consumer-sized units at the terminal market requires an additional packaging activity, since the apples have been previously packaged for shipping where they were produced. Similar practices, though to a lesser extent, are used with pears.

A shipping-point consumer pack consisting of a pulp board tray that holds four to eight apples or pears and eliminates terminal repackaging has been developed by the Transportation and Facilities Division of the United States Department of Agriculture.1/2/ Tray and fruit are overwrapped with shrink film and placed in a master container for storage and shipment. On arrival at the retail point, the prepacks are ready for display upon removal from the master container.

Reports of this prepackaging experience by United States Department of Agriculture researchers recognize both the advantages and limitations of shipping-point consumer packs and emphasize the continuing increase in consumer demand for prepackaged fruit.

Individual packaging of pears in polyethelene bags seeks to fulfill consumer demand for prepackaged fruit and to provide a better quality product. Eventually, advantages, disadvantages, and costs of this method will have to be compared with alternative methods to determine its acceptability.

/1 "Prepackaged for Consumers," Agricultural Research, United States Department of Agriculture, December 1961.

/2 James D. Fountain, Prepackaged Medium Sized Apples--Shrink Film at Shipping Plant, Marketing Research Report No. 534, USDA, Agricultural Marketing Service, Transportation and Research Division, April 1962.

Objective

Test packaging of pears in plastic bags had two objectives: (1) to determine the influence of individual packaging on transportation and handling damage, scald severity, and shipping container cooling time, and (2) to determine consumer reaction in the market to individually packaged pears. In order to fulfill these objectives, it was necessary to develop expedient methods to package the test fruit.

At this early stage of development, it was felt that knowledge of the effects of single packaging on physical factors and on market acceptance warranted first consideration. If justified, the more costly research needed to adapt commercial packaging equipment and methods and to make economic evaluations would follow.

Packaging Method

The sample bag shown in Figure 1 is made of 1 1/4 mil polyethylene film. Dimensions of the envelope are 5 inches by 8 inches with the opening across one 5-inch end. Bead seals run the length of the 8-inch sides. The back of the envelope is one inch longer than the front to provide room at the top for the staple that holds 100 bags in a stack on a cardboard backing plate. Aeration for the fruit was provided by four 1/8-inch holes in each bag.

During harvest time in Hood River, size 90 and 100 U. S. No. 1 D'Anjou pears were brought to the pilot packaging area in field lugs. Pears were moved singly by an operator from the lug to the bag packager. An air jet held the top bag of the stack open so that the pear could be easily inserted. A second operator picked up the opened bag containing a pear and positioned it in a chain bead sealer. This machine cut off the excess end of the bag, heat sealed the edge, and discharged the bagged pear into an automatic box filler. Filled boxes of single-packed pears were moved on pallets to cold storage. Bagging and seaming operations are illustrated in Figures 2 and 3. Minimum crew required for the pilot line was two women for bagging and sealing and one man to handle incoming and outgoing boxes of fruit. During free moments, the man would help with packing activities.

Methods and equipment used were adequate for the test pack, although it is apparent that direct labor costs would be much higher than for current packing techniques.

Twenty boxes of single-packed pears to be used for later physical observations were placed in Tray Pack K-42 Fiberboard cartons and taken to cold storage facilities at the Department of Horticulture, Oregon State University. One thousand field lugs of pears prepared in individual bags for subsequent consumer tests were placed in cold storage

Figure 1. Polyethylene 1 1/4 mil film bag used as an individual pear wrap for 1,000 boxes of experimental fruit. After filling, the open end of the bag was trimmed and bead sealed.

Figure 2. A mechanical device holds and opens bags for hand filling with individual pears.

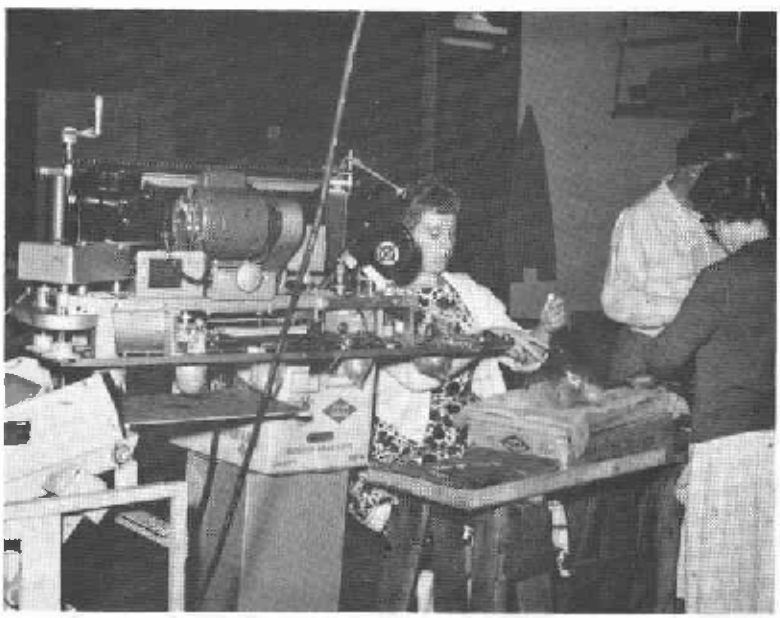


Figure 3. Single bags are fed into the machine for trimming and sealing. The fruit is discharged into an automatic box filler.

at Hood River. Five hundred boxes marketed in the Portland area were shipped the short distance in the lugs. Another 500 boxes to be sent to the Los Angeles area were repacked at shipping time into Tray Pack K-42 Fiberboard cartons.

Physical Test Methods and Results

Transportation tests. Comparative tests between the single pack and the standard paper wrap were limited to small samples. The results were sufficiently decisive to indicate the need for changes in packaging, handling methods, or treatment of the fruit.

Six tray-pack fiberboard cartons with telescope lids were used for the first transportation test. Pears in Hartman paper wraps were in three boxes and the other three contained fruit in individual polyethylene bags. Fruit for this test was free of apparent bruises and skin burns when it left the campus in early January. Transportation by refrigerator truck carried the test boxes slightly over 1,000 miles in a seven-day period. During delays at transfer points, the pears were placed in cold storage.

Upon return to Corvallis, all the transportation test fruit appeared to be in good condition except for one single-pack box that showed evidence of rough handling. In this box, skin burn was apparent on a number of pears on the top layer. After six days in a 70°F. conditioning room ripe pears from two boxes of each type were carefully inspected for physical handling damage.

Results of the first transportation test, summarized in Table 1, show that skin burn on pears due to friction was not eliminated by individual polyethylene bags. Discoloration was especially frequent where the fruit was in contact with the molded tray or the lid of a container. This is illustrated in Figure 4. Two pears in each type pack had burn marks that exceeded 1 square inch in area. Evidence of skin burn through the polyethylene was a reversal of an earlier experience observed at Hood River in running 80 bagged D'Anjou pears on a return-flow belt on which the fruit was transferred 18 times by a "power shunts." Though this caused the fruit to generally slide across the transfers rather than roll, no burning was apparent from this type of friction after the fruit was ripened.

Lack of abrasion protection from the duration and nature of truck transportation led to further container tests. Four new packages were prepared from damage-free fruit in storage. Since the main interest now was in improving the performance of the single pack, all

Table 1. Skin discoloration damage from friction to pears shipped 1,000 miles by refrigerated truck in tray-pack fiberboard cartons; the fruit was ripened prior to inspection

	Type of pack			
	Single-pack skin burn damage		Hartman-wrap skin burn damage	
Layer[1/]	Box 1	Box 2[2/]	Box 1	Box 2
Top	1	12	3	4
2nd	0	4	2	1
3rd	1	0	1	0
4th	1	1	1	0
5th	1	0	1	0
Total	4	17	8	5

/1 There were 20 pears per layer totaling 100 per box.

/2 It appeared that this box had not been kept right side up during the total travel time.

pears for the next observation were placed in individual polyethylene bags. Containers were designed with the following characteristics:

Box 1. Same type pack as first test with the addition that lids were secured with tape. Fiberboard cartons, tray-pack, 100 fruit per box in 5 layers of 20 pears each; no pressure pads, no pressure on fruit.

Box 2. Same as box 1 with the addition of pressure pad; telescope lid taped on while under pressure.

Box 3. Standard wood box with 100 place-packed pears; lid nailed and crowned to maintain pressure.

Box 4. Fiberboard citrus carton, volume filled with 85 loose pears; fruit settled by shaking box; telescope lid taped on while under pressure.

This second group of experimental containers was shipped by refrigerator truck over the route followed in the first test. Upon return, they were immediately placed in cold storage. Four days later they were observed for arrival condition and placed in a conditioning room to mature before final inspection. Arrival condition of the fruit and

Figure 4. When no pressure pads were used, top layer single-pack pears showed skin burns from rubbing on the fiberboard tray. This fruit was photographed after ripening.

of the containers are given in Table 2. Box No. 1, fiberboard tray-pack without pressure pad, lost its comparison performance value due to severe container damage en route.

Fruit condition following ripening in the second group of four boxes is shown in Table 3. Favorable results, revealing only two small skin burns, were obtained in Box 2, the fiberboard tray-packed carton with a pressure pad and secured lid. Separation of the fruit by the trays and sufficient pressure to permit little movement between the fruit and the tray prevented bruising and puncturing and nearly eliminated skin burns.

Table 2. Arrival condition of test packs containing pears in individual polyethlene bags following shipment of 1,000 miles by refrigerated truck

	Container	Arrival condition	
Box No.	Design	Container	Top layer of fruit
1	Fiberboard tray pack. No pressure pad. Lid taped.	Carton crushed & torn at top and one end. Trays broken up. Dirt & gravel inside box. Lid tapes intact.	Only 3 pears in fragments of top tray. One crushed & rotting. Several poly bags torn. Some dirt in skin breaks.
2	Fiberboard tray-pack with pressure pad. Lid taped while under pressure.	Carton condition good. Fruit settled & lid slightly slack. Lid tapes intact.	One pear with very slight skin burn.
3	Standard wood box, place-packed.	Box condition good, some pressure still on fruit.	Moderate skin burn on top center pear. Very slight marks on a few other pears.
4	Volume filled fiberboard citrus box. Lid taped while under pressure.	Carton condition good. Sides slightly bowed. Fruit settled & lid slightly slack. Lid tapes intact.	Two pears with moderate skin burn.

Considerable bruising was present in the standard wood box, No. 3, indicating that the pressure of the crown lid may have been excessive. A number of pears also showed evidence of skin burn. Many of the burns occurred where the bead seams were under compression between two pears or between the fruit and an inner surface of the box. Numerous burns were superimposed on flat-spot bruises. Skin burns caused by the bead seals are shown in Figure 5.

Skin burns in box No. 4, the volume-filled fiberboard container, were moderate. Again, most of them were the result of bead seals pressing against the fruit.

Table 3. Condition of pears in test shipping boxes following a 1,000 mile haul by refrigerated truck; inspection was made of ripened fruits

Box No.	Container design	Damage type per 100 pears per box: Skin burn, Under 1 in. sq.	Skin burn, Over 1 in. sq.	Bruises	Punctured or crushed	Total damage
1	Fiberboard tray-pack, no pressure pad.	2	5	4	7	18
2	Fiberboard tray-pack with pressure pad.	2	-	-	-	2
3	Standard wood box, place-packed.	15 1/	11 1/	17 2/	-	43
4	Volume-filled fiberboard. 3/	3.5	6	-	-	9.5

/1 Numerous skin burns occurred along the seam lines of the plastic bag.

/2 Skin burns frequently appeared in combination with flat bruise spots.

/3 This citrus-type carton held 85 pears. For comparison with other containers, damage figures have been adjusted upward to the 100 fruit per box level.

Transportation tests of a small number of boxes did not provide the uniform handling control that is possible in large unit loads. For this reason, subsequent tests were simulated to eliminate unknown handling variables, and thus obtain a better measure of comparative performance of different containers and packing methods. In addition, defects resulting from the single-pack polyethylene bag suggested modifications in the bag design. Pilot-line equipment was not available to pack experimental fruit the following season, but it was possible to make up a limited number of test containers of fruit by hand-packaging methods.

A foundry mold jolter available in the Production Technology Department at Oregon State University, was adapted to simulate transportation on a few tests in place of truck shipping in which uniform handling was

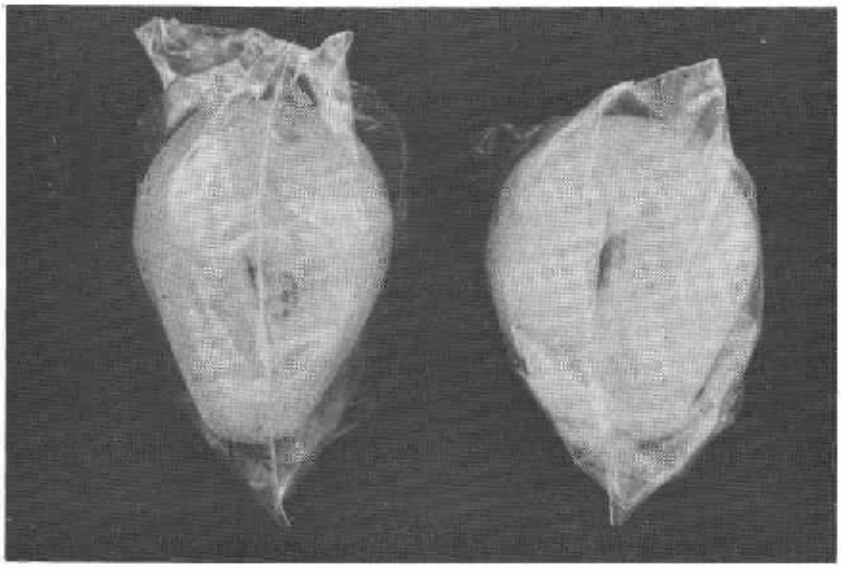


Figure 5. Shipping vibration and pressure caused skin burns directly under the bead seal of the bag.

so difficult to obtain. Though the action of this machine did not exactly duplicate commercial transportation, the shaking motion could be controlled to give each experimental box an identical treatment. Rails were clamped to the jolter platform so the box could ride unattached but still not work its way off the machine. Each box was placed on its side to conform to the usual shipping practice. The machine operated at about 320 cycles per minute. Each box was on the jolter for 75 minutes, receiving about 24,000 cycles of up and down motion. Platform and box moved 5/8 inch vertically. As the platform changed direction from up to down, the box had a free motion of about 1/8 inch. Arrangement of the equipment and test box is shown in Figure 6.

Three boxes were tested. One for control purposes was a standard pack using Hartman wraps on the fruit and a polyethylene box liner. A second box contained fruit in the same type bead-seal single bags used for the earlier truck transportation tests. Since a hand heat sealer was used to close the bags, the bead seals occurred on only two edges of the bag rather than on the three obtained with machine sealing. Bags for the third box were made from 1-mil polyethylene tubing. Ends were closed with a hand sealer making lap joints and thus eliminating all bead seals.

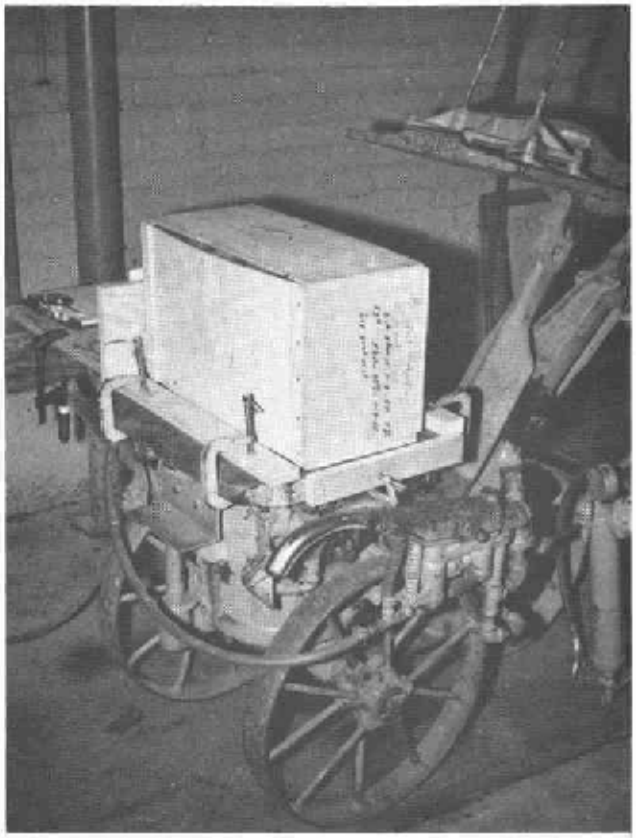


Figure 6. Use of a mechanical jolter for simulated transportation added control to comparative tests.

Following the simulated transportation treatment, the three boxes were placed in a conditioning room at 70°F. for nine days. When removed for inspection, they were at prime maturity.

Fruit condition upon inspection is recorded in Table 4. Since the position of the boxes on the jolter was known, it was possible to record observations of fruit damage by layers from the top side to the bottom side. All skin burns were recorded irrespective of their severity. This was a quantitative rather than a qualitative measure, and particular note should be made that skin burns in the two boxes of single-pack fruit were too light to cause a grade reduction. The smallest number of burns were on fruit in the paper wraps; however, some of the discolored areas were more extensive than those on individually bagged fruit. In the

Table 4. Condition of D'Anjou Pears following a simulated transportation test

Box	Type of pack in st'd wood box size 90 - fancy grade	Layer	Damage type[1/] Skin burn	Puncture	Bruise Under ½"	Bruise Over ½"	Total damage
A	Hartman paper wrap	Top	3.3	1.1	3.3	3.3	11.0
		2nd	2.2	1.1	2.2	2.2	7.7
		3rd	2.2	1.1	1.1	5.5	9.9
		4th	2.2	2.2	2.2	2.2	8.8
		Bottom	2.2	0.0	3.3	1.1	6.6
		Total	12.1	5.5	12.1	14.3	44.0
B	Single-poly bag[2/] 1¼ mil 2 sides bead seal 1 side lap seal	Top	2.2	0	0	4.4	6.6
		2nd	3.3	0	0	3.3	6.6
		3rd	6.6	0	0	0	6.6
		4th	5.5	0	1.1	1.1	7.7
		Bottom	11.1	0	0	0	11.1
		Total	28.7	0	1.1	8.8	38.6
C	Single-poly bag[2/] 1.0-mil tubing 2 sides lap seal	Top	2.2	0	0	0	2.2
		2nd	2.2	0	0	0	2.2
		3rd	4.4	0	0	0	4.4
		4th	5.5	0	1.1	0	6.6
		Bottom	2.2	0	0	0	2.2
		Total	16.5	0	1.1	0	17.6

/1 Damage figures have been adjusted in terms of 100 pears per box rather than the 90 actually contained; hence, they are not whole numbers.

/2 Skin burns were very light and probably would not have caused any change in grade.

boxes of individually wrapped fruit there were 16.5 burns per 100 fruit for pears in lap-sealed bags and 28.7 burns for those in bead-sealed bags. This small test indicates that individual bags with lap seals have the desired effect of reducing burns.

As in previous tests, the simulated transportation test showed that the strength of the polyethylene film gave excellent protection against skin punctures and greatly reduced the bruising associated with the standard pack.

Other packaging influences. Several physical characteristics of single-pack and paper-wrapped pears are summarized in Table 5. The packaging method caused no significant difference in the pressure test of fruit in storage as time progressed. Dessert quality after conditioning was also comparable. While observing fruit during storage and at retail stores, it was noted that individually bagged pears had very little evidence of stem-end shrivel. By April, decay, largely of stem-end type, was occurring on pears in both wraps.

Table 5. Comparative physical test results of samples of D'Anjou pears packed individually in polyethylene and in Hartman paper wraps

	Physical characteristics[1/]							
	Pressure test		Dessert quality		Decay percent		Scald percent	
Month	Poly	Wrap	Poly	Wrap	Poly	Wrap	Poly	Wrap
Dec.	13.5	13.6	Good	Good	None	None	None	None
Jan.	13.0	13.1	Good	Good	None	None	None	None
Feb.	12.5	13.4	Good	Good	None	None	None	None
March	12.5	11.5	Fair	Fair	None	None	40	3
April	11.2	11.0	Poor	Poor	22	11	36	5

/1 Pressure tests were made when pears were removed from 30°F. storage. Other tests were made after the fruit had ripened 6 to 8 days at 70°F.

Scald on pears in polyethylene bags held through March and April was severe compared to fruit in Hartman wraps. This fruit had received no scald-inhibiting treatment. Since scald would seriously detract from marketing pears in individual bags, a test was designed to evaluate the effectiveness of Stopscald. Laboratory application of Stopscald was compatible with commercially feasible standards.

Observations in Table 6 verified the high scald incidence on late-storage untreated pears in single bags. Hartman wraps reduced both the severity and quantity of scald with a total occurrence of 59.6 percent, as compared to 81.1 percent untreated single-pack fruit. Light scald of 2 percent resulted on single-pack fruit treated with Stopscald, indicating that satisfactory protection may be possible without use of the paper wrap. This performance is similar to the 95 to 100 percent control obtained in tests over a period of four seasons by Dr. Elmer Hansen, Department of Horticulture, Oregon State University.

Table 6. Scald intensity by percent on test treatments of D'Anjou pears

Treatment[1/]	Amount of surface with scald			
	Less than 1/4	1/4 to 1/2	Over 1/2	Total
Hartman[2/] wrap	44.7	12.8	2.1	59.6
Single-pack[3/] no Stopscald	33.8	24.3	23.0	81.1
Single-pack[4/] with Stopscald	2.0	0	0	2.0

/1 Loose orchard-run pears from cold storage were used for all treatments. All fruit was inspected for scald on April 7, 1964, after being conditioned seven days at 70°F.

/2 This fruit was removed from cold storage November 14, 1963, placed in Hartman wraps, packed in a box with a polyethylene liner, and returned to storage.

/3 Pears were removed from cold storage November 14, 1963, packed in individual polyethylene bags, and returned to storage.

/4 Fruit was removed from cold storage November 12, 1963. The core temperature was allowed to rise to 56°F. before dipping on November 14 for 15 seconds in a solution containing 2,700 parts per million of Stopscald. When dry, the fruit was packed in individual polyethylene bags and returned to cold storage.

Cooling time. A change in packaging should include consideration of possible influence on cold-storage cooling facilities. An indication of cooling rate was obtained by comparing a standard wood box containing tissue-wrapped pears in a polyethylene bag liner with a like box containing single-packed pears. In each case, a thermocouple was inserted into a fruit at the center of the pack. These boxes were placed in 30°F. cold storage room in such a way that they had free circulation on all sides. Thermocouples from the two boxes and one for room temperature were attached to a recording thermometer. No other warm fruit was in the room during the test period. Upon entering cold storage, the respective core temperatures were 65°F. for the single-pack pears and 64°F. for the standard pack. Air temperature in the storage room was 30°F. Cooling time to 32°F. required 39 hours for a drop of 33°F. for the single pack and 52 hours to drop 32°F. for the standard pack. Savings in cooling time for individually bagged pears was 25 percent.

The improved cooling rate for the single-packed fruit possibly was due to more free circulation. The polyethylene liner used in the standard box inhibits air movement through the fruit. Ability to reduce cooling time would result in improved product quality.

Projections for Individually Packaged Pears

Tests of physical response and consumer and trade reaction to individually packed pears have not been exhaustive. However, evidence thus far does show that bruising and puncture damage is reduced. No serious deterrent to further consideration of single packing has been revealed. Although skin burn was evident in some single packs, there was indication that package design could bring this defect to an acceptable level. Scald control and improved cold storage cooling are attainable with individually bagged pears. Members of the produce trade who had an opportunity to handle the single-packed pears revealed interest in obtaining further experience with the new pack. A reasonable acceptance was also evident among consumers.

In view of this experience, and since information from actual practice is unavailable, some anticipation of possible requirements for commercial production is appropriate.

Any firm contemplating single packing would face an early decision to establish the quantity, grades, and size of fruit to direct to the new pack. This step would govern new equipment requirements, modification of current packing lines and plant facilities, and the ordering of film, containers, and other necessary materials. It is unlikely that more than one pilot line would be installed until sufficient experience was available to add confidence to single-pack cost and marketing decisions. Even with more specific information, expansion of the single-pack production would add new evaluation requirements regarding equipment flexibility for handling a range of fruit sizes and varieties.

Simplified flow process charts shown in Figures 7a, 7b, and 7c compare steps for the present packing method with two single-pack methods. Each chart shows the main activities performed on the pears as they move from the receiving box to final shipping from the plant. On the charts, only primary packaging and handling materials related to packing are brought into or taken out of the process at appropriate places.

Packing activities for the conventional wood box are charted in Figure 7a. The individual-pack method shown in Figure 7b is similar to the conventional method, except that the pears are put in individual plastic bags at harvest season and placed in wood boxes by volume fill rather than hand packing. They are then placed in cold storage until shipped. There is no difference in handling methods through sizing activities. However, following this point, some type of accumulator or even-flow device is needed so outputs from the sizer will not have

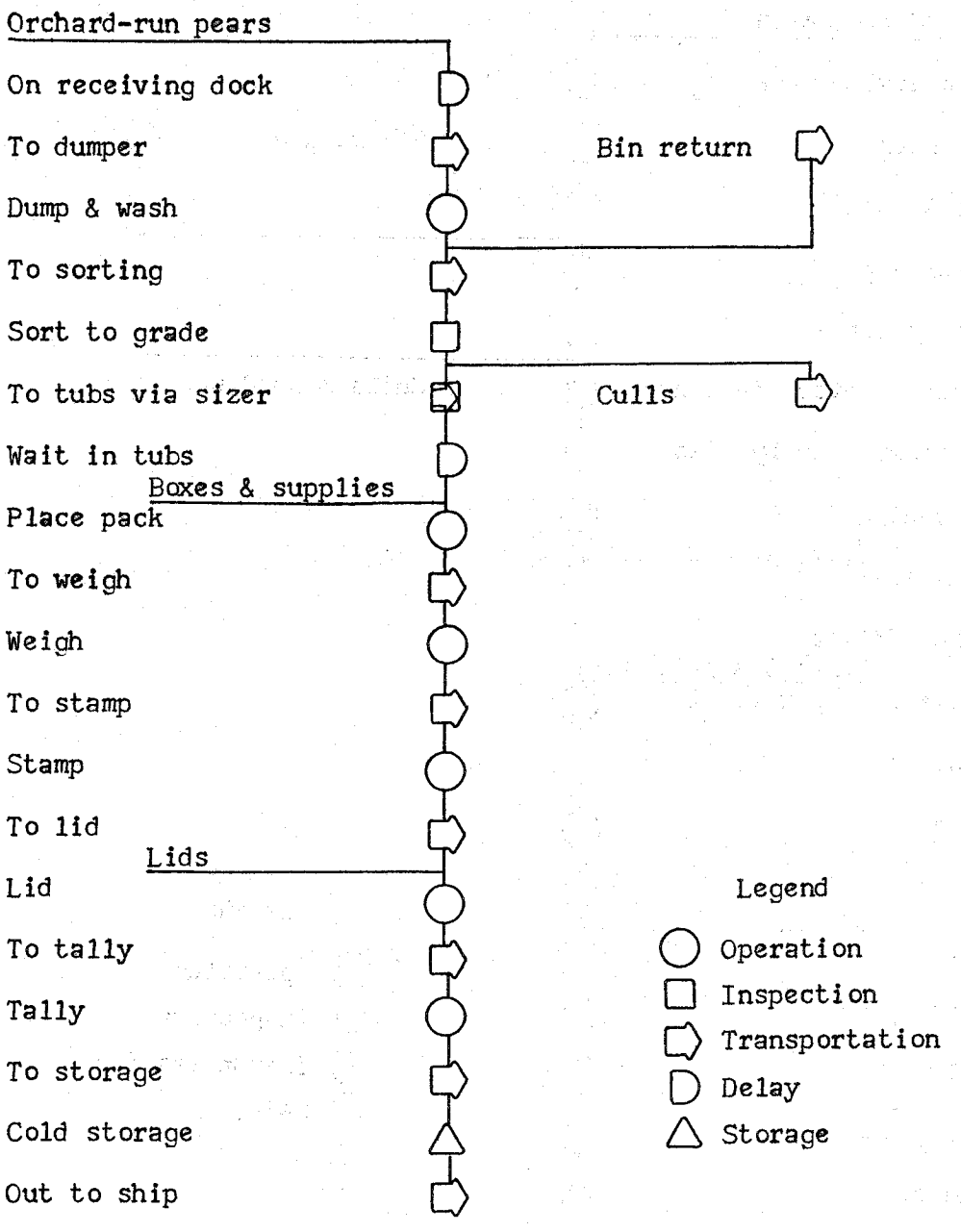


Figure 7A. Material flow process chart for hand packing paper wrapped pears in standard wood boxes.

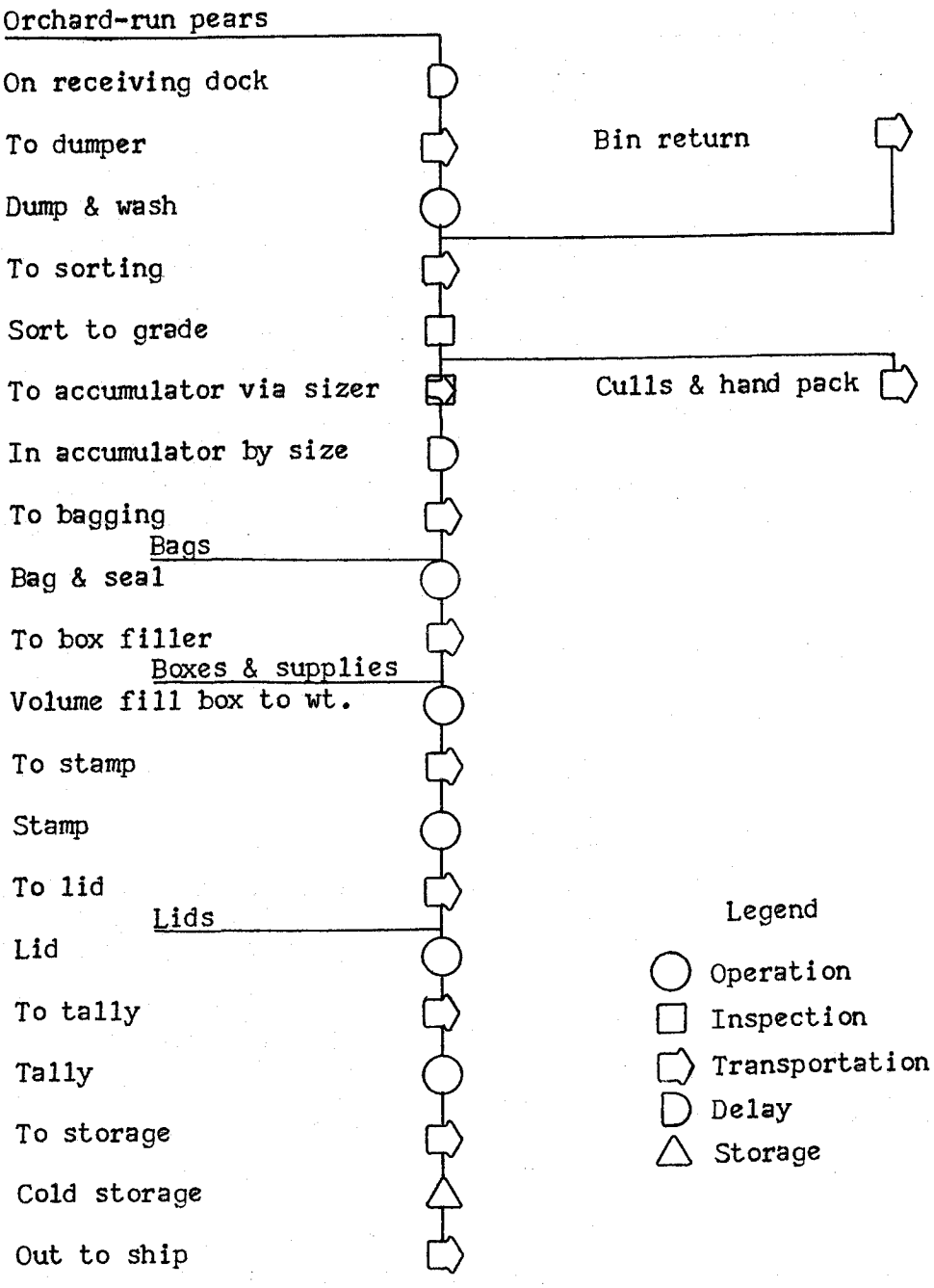


Figure 7B. Material flow process chart for volume filling individual polyethylene bagged pears into standard wood boxes at harvest time.

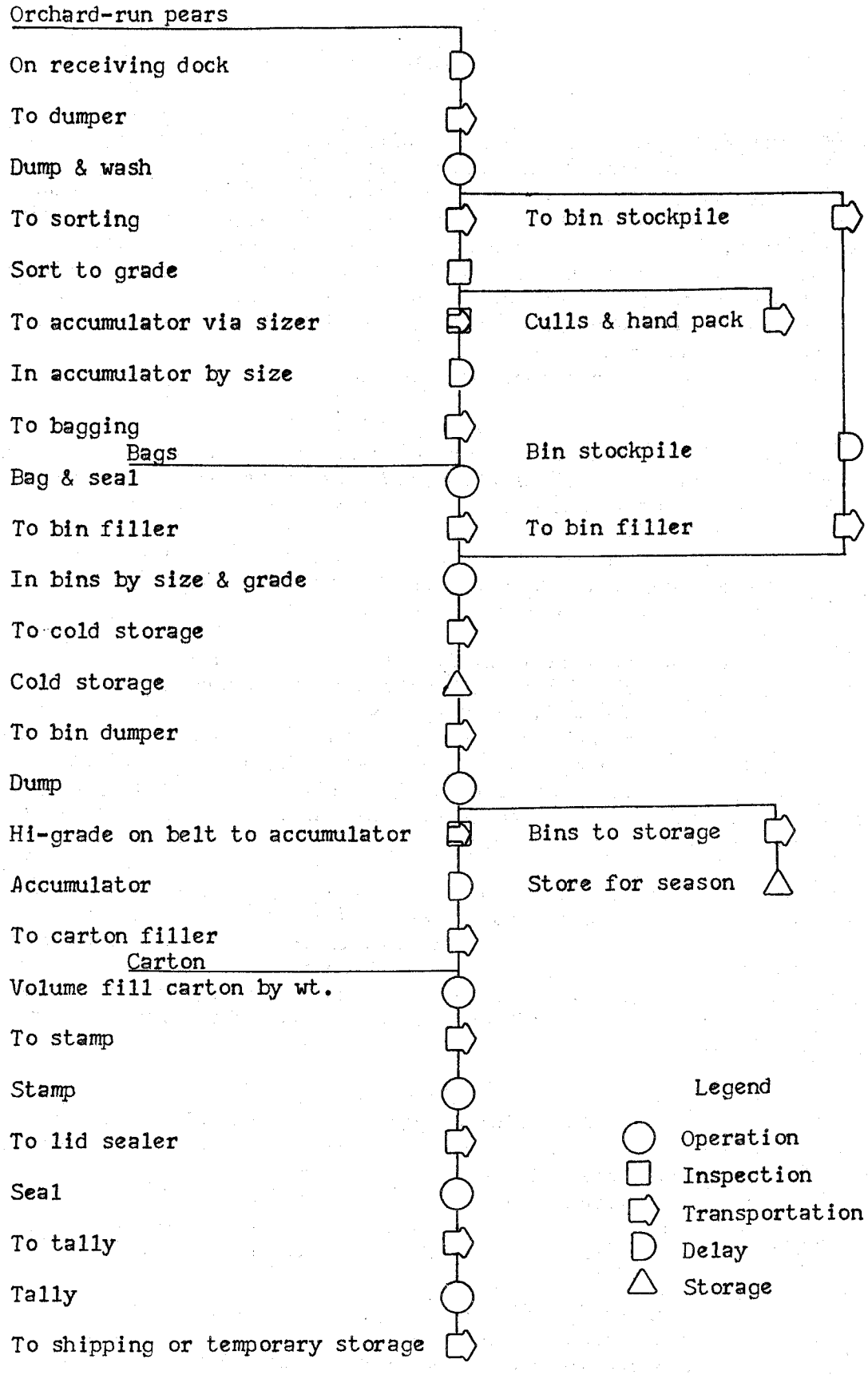


Figure 7C. Material flow process chart for single-bagging pears at harvest time and volume filling them, following bulk storage, into cartons as required by sales orders.

to be exactly balanced to the input requirements of the packaging machine. Automatic or semi-automatic box filling may be possible, since the lubricating quality of the plastic film permits the fruit to slip easily and settle into position. Volume filling may be an aid in substituting increased equipment cost for some of the high cost of hand packaging. Experience is needed with the volume-fill technique to determine whether current box dimensions and weight can be met with the pears in random positions. A shaker at or just following filling may be needed to eliminate excessive voids in the pack. From this stage through moving out of storage for shipping, operations are identical to those for the conventional wood box pack.

Unless container dimension adjustments are required, the only changes in materials would be the elimination of paper wraps and polyethylene box liners and their replacement by individual plastic bags.

The alternative single-pack technique outlined in Figure 7c involves more operations, handling, and equipment; but in turn adds flexibility and possibly other advantages.

There is no change in handling from the other methods through the sizing operation. Some of the bins emptied at the dumper, however, are routed for later filling with individually bagged fruit. In the other systems, they were available for return to the orchard or to off-season storage. Following grading and sizing, the pears are routed through an accumulator to the bagging equipment. From this point the bagged fruit is transferred to bins and moved to cold storage. Later, fruit is brought out of storage as required by sales orders.

Bins used for storage would not be available for further harvesting, but their use as bulk storage containers would eliminate the need to have shipping boxes for the total pack available for the whole storage season. Also, bulk bins often increase the utilization of storage space. Cooling tests with apples[3/] have indicated that when using bulk boxes, cooling rates generally are as good or better than those for standard boxes on pallets.

Bulk storage of single-pack fruit would require the addition of bin-dumping equipment. Following dumping and before volume filling shipping containers, there would be an opportunity to again inspect the fruit and remove those with decay and other defects that may have occurred during the storage. Most disorders are easily observed through the clear plastic bags. Inspection just prior to shipping would add to confidence in the condition of the fruit and eliminate some sources

---

/3 Glenn O. Patchen, and G. F. Sainsbury, Cooling Apples in Pallet Boxes, Marketing Research Report No. 532, Agricultural Marketing Service, Transportation and Facilities Research Division, USDA, August 1962.

of further decay that might occur during shipping.

From this stage, empty bins would move to storage and the pears would proceed as in the previous method to an accumulator feeding a volume box filler. Since the shipping containers would not be in cold storage for a long period, it would be possible to use fiberboard boxes rather than wood. This would require carton sealing facilities in place of the box lidder. Use of pressure pads and secured lids would provide better protection to the fruit during handling and transportation activities.

Resistance of single pack fruit to physical damage also suggests its potential use in future developments of bulk shipping methods. Such an application, if successful, could lead to simplification of several operations within the packing house.

II. CONSUMER ACCEPTANCE OF PEARS IN INDIVIDUAL POLYETHYLENE BAGS

R. H. Groder

Objectives

The objectives of this study were: (1) To determine the volume of poly-wrapped pears the consumer would purchase in relation to the volume of conventionally wrapped pears; (2) to determine the number each customer purchased at one time; (3) to determine the age grouping of pear customers; (4) to determine the time of day most pear purchases are made; (5) to determine if the poly-wrapped pears on display had as much eye appeal as conventionally wrapped pears; (6) to determine the percentage of pear customers that purchased on impulse; and (7) to measure repeat purchases of individually poly-wrapped pears.

Method of Study

This study was conducted during the period January 15 to February 9, 1963, in four retail stores located in three areas in Oregon; two in Portland, one in Eugene, and one in Springfield. These locations were selected because of the cross-section of all levels of income represented by their residents.

D'Anjou pears grading U. S. EXTRA FANCY were used for the test. After being sized, sorted, and inspected for bruises, stem punctures, and other external defects, the graded fruit was hand fed into the wrapping machine, packed in field lugs, and stored at 30°F. to be shipped from the packing house to the wholesale distribution center in Portland, Oregon.

At the distribution center the fruit was held in storage at approximately 41°F. until shipped to the retail stores. The test fruit was handled in the normal manner with no attempt to give it special handling.

In each of the four stores, two pear displays were erected side by side, one of poly-wrapped and one of unwrapped. Both displays were of the same size, contained the same size fruit, and bore the same price tag. Uniformity in appearance and maturity of fruit were maintained throughout the study. Bruised and discolored fruits were removed from the displays when it was believed that appearance would affect sales or influence a consumer's choice. Promotional material was uniform at both displays.

Pear prices were competitive with apples, oranges, and bananas throughout the four-week test period. However, each week one of the four fruits was featured as a weekend special.

The regular price of apples and pears was 19 cents a pound; the special price was two pounds for 29 cents. Oranges ranged in price from 11 cents a pound to 19 cents a pound during the four-week test period, and bananas ranged from 10 cents to 19 cents a pound. All fruit was of good quality, but the citrus and bananas occupied more space in the produce departments than did any one of the varieties of apples or pears.

The in-store study was conducted in two phases; (1) The observation phase and (2) the direct interview phase. The enumerator had a questionnaire divided into two parts--A and B (see following page). Part A was completed from observation and Part B by direct interview. At the start of the study, enumerators were in the stores each week on Thursday, Friday, and Saturday between the hours of 10:00 a.m. and 9:00 p.m.

This was changed after the second week. In Eugene and Springfield there were too few customers and enumerators were discontinued. In Portland the hours were changed from Friday and Saturday nights to Wednesday afternoons.

Results and Discussion

During the test period, 308 interviews and observations were completed. One hundred eighty-two purchases were of the poly-wrapped fruit, 106 of the conventional type, and 20 purchases included both types. However, based on total sales in the four test stores, unwrapped pear sales were 13 percent larger than those of poly-wrapped fruit.

The number of pears in each purchase ranged from 1 to 12 with the greatest number of purchases, 109, consisting of only 2 pears each.

Table 1 shows the number of pears in each purchase and the percentage of purchases. Thirty-five percent of the purchases were made two pears at a time, 18 percent, three pears at a time, and 22 percent, four pears at a time. Only three customers purchased more than six pears at any one time. One purchased 8, one purchased 9, and one purchased 12.

In interviewing customers regarding the number of pears purchased, it was learned that many customers buy pears to place on a fruit dish one or two at a time, some use the fruit in salads, while

RECORD NO._____

MARKETING STUDY - INDIVIDUALLY POLY-WRAPPED PEARS
OREGON STATE UNIVERSITY - 1963

CONSUMER PHASE: DATE:_____, 1963 STORE NO.____ENUMERATOR_____

PART A

OBSERVATION:

1. Type Pear Purchased: Poly-Wrapped_____ Conventional_____
2. Number of Pears Purchased: _____
3. Sex of Purchaser: Male _____ Female _____
4. Approximate Age of Purchaser: Under 21 _____ 35 to 50 _____
   21 to 35 _____ Over 50 _____
5. Approximate Time of Day Purchase Made: _____
6. Did Consumer Look At, Inspect, View or Consider Both Displays Before Making Pear Purchase? YES _____ NO _____

PART B

INTERVIEW

1. Did you plan to buy pears before entering the store?
   YES _____ NO _____
2. Have you purchased poly-wrapped pears previously?
   YES _____ NO _____
3. If "YES" do you like the poly-wrap? YES _____ NO _____
4. What do you like about the new wrap?

   _____ _____ _____
   _____ _____ _____
   _____ _____ _____

5. What do you dislike about the new wrap?

   _____ _____ _____
   _____ _____ _____
   _____ _____ _____

6. May I have your name and address?

   _____ _____
   NAME ADDRESS

Table 1. Number of pears each purchase, number of purchases, and percent of total pear purchases

Number of pears each purchase	Number of purchases	Percent of total pear purchases
1	23	8
2	109	35
3	54	18
4	69	22
5	24	8
6 or more	29	9
TOTAL	308	100

others use the fruit to eat out of hand or serve to diabetic patients in nursing homes. However, nearly all answered that they had to ripen the fruit at home. Therefore, they only purchased one or two pears at a time.

Age of customers buying pears:

The estimated age of pear customers fell heavily to the older groupings as shown in Table 2.

Table 2. Estimated age of pear customers by number and percent of customers in each age group

Age group	Number of customers	Percent of customers
Under 21 years of age	6	2%
21 to 35 years of age	70	22%
35 to 50 years of age	107	35%
Over 50 years of age	125	41%

Time of purchase:

Most of the pear purchases were made between the hours of 12:00 noon and 6:00 p.m. The study showed 61 pear customers between 10:00 a.m. and 12:00 noon; 67 between 12:00 and 3:00 p.m.; 162 between 3:00 and 6:00 p.m.; and 15 customers between 6:00 p.m. and 9:00 p.m. No determination or comparison was made between days of the week.

Eye appeal of poly-wrapped pears:

By observation it was determined whether or not each customer observed, noticed, or inspected both the poly-wrapped and the unwrapped fruit. Two hundred fourteen, or 69 percent, did look at both displays and 88 customers, or 29 percent, did not.

Of the 214 customers who looked at both displays, 131 purchased poly-wrapped fruit, 63 unwrapped fruit, and 20 bought some of each. Of the 88 customers who did not observe the two displays, 46 purchased poly-wrapped fruit and 42 the conventional.

Repeat purchasing:

Customers were asked if they had purchased poly-wrapped pears previously, and if so, did they like the poly-wrap. One hundred fourteen, or 39 percent had purchased previously and 95 of these, or 83 percent, said they liked the poly-wrap. However, three purchased the unwrapped fruit when they made an additional purchase.

Nineteen said they did not care for or like the poly-wrap, but six of these purchased the poly-wrap on repeat purchases.

Impulse buying of pears:

Of the 308 customers interviewed, 306 were asked if they had planned to buy pears before entering the store. Of the 306 pear customers questioned, 150 purchased on impulse. Of these, 55 percent chose poly-wrapped pears; 34 percent unwrapped pears; and 11 percent purchased some of each as shown in Table 3. Of the planned purchases, 61 percent were poly-wrapped, 36 percent unwrapped, and 3 percent some of each.

Table 3. Number of impulse pear customers and number and percent of customers that purchased poly-wrapped and unwrapped fruit

Type of pears purchased	Number of customers	Percent of customers
Poly-wrapped	83	55
Unwrapped	51	34
Both types	16	11
TOTAL	150	100

Likes and dislikes:

Customers were asked for their likes and dislikes of the poly-wrap. Some of the more frequent comments follow:

A. Favorable comments regarding poly-wrapped fruit:

1. Fruit more sanitary. Not handled by customers.
2. Pears keep better. Wrap offers greater protection.
3. Easier to handle, store, and pack in lunches.
4. Seems to reduce spoilage. Pears hold longer.
5. Pears keep longer without turning brown.
6. Fewer stem punctures. Less rubbing together.
7. Pears ripen more evenly.
8. Pears look better, more attractive, and appetizing.
9. The wrap keeps the pears more moist.
10. Children like the wrap, they use pears faster.
11. Wrap gives impression of better quality fruit.

B. Unfavorable comments regarding poly-wrap:

1. Will cost more once consumer accepts it.
2. Pears do not ripen as fast.
3. Customer prefers unwrapped fruit.
4. Can't see any need for wrap. Unnecessary, senseless.
5. Gives fruit an off flavor.
6. Fruit does not keep as well at home as unwrapped.
7. Can't see fruit as well.
8. Pears were drier and mealy.

C. Comments by retail store personnel:

1. Favorable

a. Better appearance and more eye appeal.
b. Less stem punctures.
c. Easier to handle.
d. Less bruising.
e. Less stacking time.
f. Pears ripen quicker and more evenly.
g. Increased shelf life.
h. Better than 95 percent of pears sold for full price.

2. Unfavorable

   a. Display has less eye appeal.
   b. Customers can't tell if fruit is ripe.
   c. Shelf life was decreased.
   d. Reduced total sales.
   e. Pears sweat inside wrapper.
   f. Takes longer to ripen.

Most produce managers and check-out girls agreed that ease in handling, fewer stem punctures, and increased shelf life were the greatest advantages of the poly-wrap. Seventy-five percent would like to see the experiment continued and would be willing to participate in such an experiment.

California Phase

In California the consumer acceptance phase of this project was conducted by Mrs. Helen Goodrich, Area Home Economist, California Extension Service, assisted by Mrs. Cora Mae Comstock, representative of the Oregon-Washington-California Pear Bureaus.

The same questionnaire was used in California as in Oregon. However, the pears were distributed to a larger number of stores, and the enumerators were unable to spend as much time in each store as did enumerators assigned to specific stores in Oregon.

The results obtained in California can be summarized as follows:

1. Thirty-five in-store observations and interviews were made. Forty-eight percent of the customers purchased unwrapped fruit, 40 percent the poly-wrapped, and 12 percent some of each.

2. The number of pears in each purchase ranged from 1 to 10 with a mean of 4 pears per purchase.

3. More women (27) than men (8) purchased pears and their estimated ages were as follows:

Under 21 -- 0	35 to 50 -- 13
21 to 35 -- 12	Over 50 -- 10

4. Most purchases were made between 3:00 and 6:00 p.m.

5. Thirty-one customers observed and inspected both displays. Four did not.

6. Twenty-six customers planned to buy pears when they entered the store and only one customer had purchased the poly-wrap previously.

Customer likes and dislikes:

A. Favorable comments regarding the poly-wrap were as follows:

1. Looks nice, is clean and more sanitary.
2. Protects pears from bruising.
3. Better quality fruit is packaged.
4. Can use fruit as a gift.

B. Unfavorable comments were as follows:

1. Likes open display.
2. Can see fruit better unwrapped.
3. Like to see and feel fruit.
4. Too much trouble to unwrap.
5. Cost more.

Produce men in California had much more to say about the market test than the consumers.

Comments received most frequently were as follows:

A. Favorable:

1. Less spoilage.
2. Easier to handle.
3. Customer handling doesn't seem to hurt fruit.
4. Customers like for school lunches.
5. Pears arrived at store without stem injury.
6. Could really push this item if we had more.
7. Would like to run test for a longer period of time.

B. Unfavorable:

1. Too many small sizes.
2. Too green in appearance.
3. No sales appeal.
4. Customers do not like wrapped produce.
5. Bulk items sell better, faster, and for more money.
6. Slows sales.
7. Had to unwrap in order to clear space.
8. This test was too late in the season.

Summary and Conclusions

In a consumer reaction or acceptance type study at the retail level, it is difficult to control and measure all of the variables that may influence a customer's actions. In many instances, customers had difficulty in explaining why they selected one item over another. In some cases they answered a survey question in the affirmative, but acted in the negative. As an example, 114 of the interviewed customers purchased pears more than once during the test period. Eighty-three of these repeat-sale customers said they liked the poly-wrapped fruit, but nearly three percent of them purchased the unwrapped fruit.

This study indicates that the greatest volume of pear purchases are made in the afternoon hours between 3:00 and 6:00 p.m. when store traffic is normally heaviest.

Although more customers purchased poly-wrapped fruit, store records on pear movement during the test period indicate that the unwrapped pear volume was 13 percent greater than the poly-wrapped volume. Factors that might explain this variance were not included in this study.

Specific conclusions that could be drawn from this study follow:

1. About one-half of the pear purchases made in the stores studied were unplanned. Fifty-five percent of the unplanned purchases and 61 percent of the planned purchases were of the poly-wrapped pears.

2. Pear purchases were made in small volume, mostly two pears at a time.

3. Pear customers were in the older rather than the younger age group.

4. Poly-wrapped fruit has as much appeal as the unwrapped fruit.

5. More repeat sales were made with poly-wrapped fruit than with unwrapped fruit.

6. The individually poly-wrapped fruit did not reduce total pear sales. In fact, pear sales were increased during the test period as compared with total sales made during a like period of the preceding year.

7. Produce men in the test stores liked the poly-wrap fruit better than the conventional wrap. It had less spoilage and required less labor to handle.

8. Poly-wrap fruit was easier to display and more attractive.

9. Customers observed purchasing pears did not place the poly-wrap fruit in a paper bag as they most always did with the unwrapped fruit. This could mean savings at the retail level.

10. The pear industry needs to carry out an educational program on handling, storing, and conditioning pears in the terminal market area.

11. Retail produce clerks need information on handling, storing, and displaying pears.

12. Stem-up displays are more attractive than blossom-end-out displays.

13. Poly-wrap fruit reduced spoilage and waste in the stores studied.

14. The pear industry should expand the experimental work being done in pear packaging and marketing.

15. Individually poly-wrapped fruit appears to have a future.