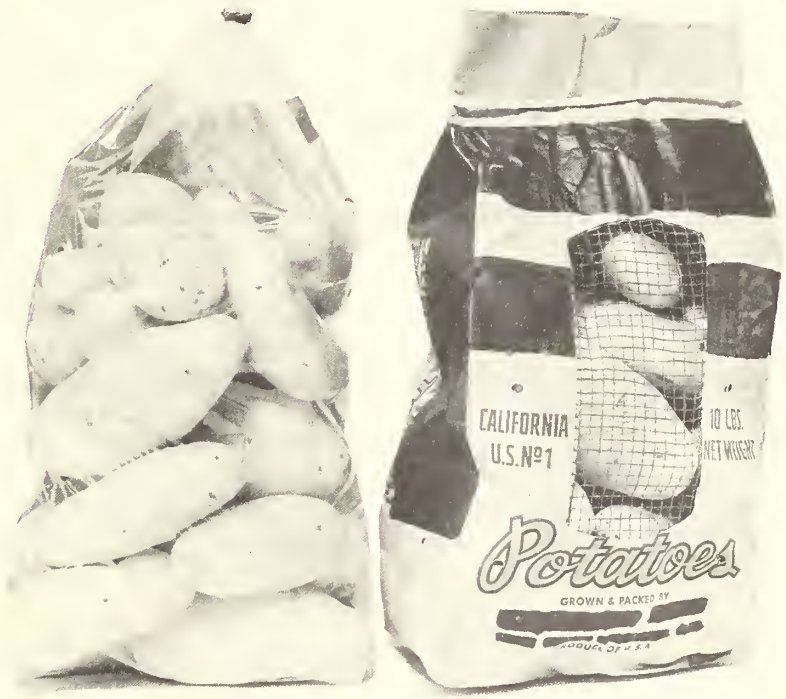
PREPACKAGING

EARLY CALIFORNIA POTATOES

AT POINT OF PRODUCTION

MARKETING RESEARCH REPORT NO. 401



UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
TRANSPORTATION AND FACILITIES RESEARCH DIVISION

PREFACE

This report is one of a number evaluating new packages and shipping containers and new methods of packing fruits and vegetables in them. The study on which the report is based is part of a broad program of research aimed at improving marketing efficiency and expanding markets for farm products.

Demands of retailers for prepackaged potatoes have grown steadily in recent years. Growers of California White Rose potatoes have been reluctant to prepackage them because of their perishability and the additional cost of materials and labor. This study was undertaken to determine the feasibility of prepackaging these potatoes at point of production.

Related publications previously issued by the U. S. Department of Agriculture include:

Fresh Produce Prepackaging Practices in the United States, Marketing Research Report 341, July 1959

Prepackaging Firm-Ripe Peaches, Interim Report, AMS-312, June 1959

Evaluation of Shipping Containers for Western Lettuce, Marketing Research Report 248, July 1958

Evaluation of Shipping Containers for Florida Avocados, Marketing Research Report 228, May 1958

Packing California Potatoes in Fiberboard Boxes, Marketing Research Report 214, February 1958

Development of Carrot Prepackaging, Marketing Research Report 185, June 1957

New Shipping Containers for Plums, Marketing Research Report 128, June 1956

Prepackaging Tomatoes, Marketing Research Report 20, October 1952

Prepackaging Apples at Point of Production, Agricultural Information Bulletin 29, January 1951

This study was initiated during the spring of 1957 and continued in the 1958 and 1959 seasons in Kern County, Calif., in cooperation with members of the Kern County Potato Growers Association.

June 1960

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SUMMARY

California White Rose potatoes, prepackaged and shipped in either 10-pound paper bags with mesh windows or 10-pound polyethylene bags, arrived at eastern markets in good condition in recent tests. Total costs of packing, loading, and transporting were about the same for both kinds of bags.

The tests were made in 1957, 1958, and 1959 with White Rose potatoes grown in Kern County, Calif., and shipped to Eastern States.

Packing and carloading 100 pounds of potatoes in 10-pound kraft-paper, mesh-window bags cost a total of 50 cents--39 cents for materials and 11 cents for direct packing and carloading labor. Packing and carloading 100 pounds of potatoes in the 10-pound polyethylene bags cost 54 cents, or 42 cents for materials and 12 cents for labor. Because of differences in tare weight, shipping costs from Kern County to New York City were less for polyethylene bags than for the paper bags. The total cost of materials, labor, and transportation to eastern markets was $2.56 for 100 pounds of potatoes packed in 10-pound paper bags and $2.57 when polyethylene bags were used, as compared with $2.19 for potatoes shipped in conventional 100-pound burlap bags.

Test lots of potatoes, prepackaged in the two types of 10-pound bags and shipped by rail under controlled conditions from California, were inspected upon arrival in eastern markets. Potatoes in the paper-and-mesh-window bags sustained much more skinning with discoloration than those in the polyethylene bags. More skinned potatoes without discoloration were found in the polyethylene bags but the total of all skinning was greater in the paper bags. Bruising (a type of injury that goes deeper than the skin), greening, and decay were at about the same very low level in both bags.

During a 7- to 9-day rail shipment to eastern markets the average weight loss in the paper bags was 7.0 ounces (4 percent), compared to a weight loss of only 1.3 ounces (0.8 percent) in the polyethylene bags.

Drying the potatoes after washing did not affect their condition on arrival, if they were packed in the polyethylene bags; but dry potatoes packed in the paper bags showed a significant increase in the amount of skinned and discolored potatoes.

Wholesale receivers and retailers alike reacted favorably to both the paper and the polyethylene bags. Those inclining towards the paper bags commented that (1) if any decay was present it developed faster in polyethylene bags, and (2) polyethylene bags gave less protection against greening. Others in the trade pointed out that (1) the polyethylene bags, which were in unitized packs of five in master containers for extra protection against damage, required less time to unload and handle than the individual paper bags, and (2) consumers preferred the greater visibility of potatoes packed in polyethylene.

PREPACKAGING EARLY CALIFORNIA POTATOES AT POINT OF PRODUCTION

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INTRODUCTION

Since 1956 the Agricultural Marketing Service has cooperated with California potato growers and packers and the Kern County Potato Growers Association in projects designed to develop and evaluate improved containers for early White Rose potatoes. Results of studies that evaluated 50-pound fiberboard boxes and conventional 50- and 100-pound burlap bags were published in 1958. 1/ These earlier studies showed that it cost more to market potatoes in fiberboard boxes than in burlap bags, but that the boxes protected the potatoes from bruising better than the bags.

The evaluation of paper and polyethylene bags for packaging California White Rose potatoes was begun during the spring of 1957. There has been an increasing demand from retailers for prepackaged potatoes. However, because the early varieties are generally more perishable than late varieties, the carrying qualities of the early varieties of potatoes packed in consumer bags and shipped to eastern markets were uncertain. This report summarizes the results of packing early White Rose potatoes in 10-pound paper and polyethylene bags during the 1957, 1958, and 1959 seasons.

Objectives

The objectives of this study were to evaluate the advantages and disadvantages of packaging early White Rose potatoes at the point of production in two kinds of consumer packages: 10-pound paper bags and 10-pound polyethylene bags. Costs of packing materials, direct labor, and transportation, as well as the condition of the potatoes on arrival at terminal markets, were evaluated.

How Study Was Conducted

Three preliminary test shipments were originated during 1957. Each rail shipment contained potatoes in 10-pound paper bags with mesh windows and in

1/ Hale, P. W., and Chapogas, P. G. Packing California Potatoes in Fiberboard Boxes. U. S. Dept. Agr., Mktg. Res. Rpt. 214, Feb. 1958.

10-pound polyethylene bags. For each test shipment, the paper and polyethylene bags were packed with the same lot of potatoes. Inspections on arrival at eastern terminals showed that packaging early potatoes in 10-pound bags was feasible. Plans were then made to expand the test program the following season.

The 1958 crop of White Rose potatoes was affected with the condition commonly referred to as "stem-end discoloration." This condition appeared under the skins of the tubers at the stem ends in the form of dark or bluish-black areas; it developed within 24 hours after handling. 2/ Three test shipments originated in 1958 were inspected upon their arrival at terminal markets. These inspections indicated that the stem-end discoloration condition was so irregular as to make additional test shipments useless in that year. Plans were then made to continue the tests the following year.

In 1959, comparative costs of material, labor, and transportation were determined and 10 test shipments of potatoes packed in paper and polyethylene bags were made.

Time studies were conducted in three potato packing plants to determine the amount of labor required for packing and carloading 10-pound paper bags. None of these plants commercially packed polyethylene bags. The polyethylene bags used for these experiments were packed on the same lines as the paper bags, but were closed and packed into master baler bags (five 10-pound bags in each master baler) by the research workers. The paper-and-mesh-window bags are not customarily packed in master bags because the packers believe that the heavy paper of the consumer bags gives adequate protection and do not consider the additional expense of baler bags necessary. In order to compare the direct labor required for the paper bags and the polyethylene bags, standard times accumulated for the paper bags were projected to equivalent operations to fill, handle, and load the polyethylene bags.

Four grower-shippers cooperated in originating 10 controlled railroad tests. The test packages were shipped between May 28 and June 12 to seven terminal markets.

To compare the amount of weight loss in transit, research workers weighed the filled paper and polyethylene bags before shipment and reweighed them upon arrival in the terminal markets.

Eight of the test shipments were inspected upon arrival in the terminal markets. One of these eight tests was followed into the retail stores and reinspected. The two tests not inspected at the market were inspected 3 days after their arrival in the retail stores. The shipments were inspected for damage to containers, and for five types of damage to the potatoes:

2/ Kern County Potato Growers Association. Causes and Control of Stem End Bruising (Stem End Discoloration, Blackspot). Yearbook, 1959.

(1) greening, (2) bruising, (3) skinned and discolored potatoes, (4) skinned-not-discolored potatoes, and (5) decay.

Limitations of the Study

Ten test rail shipments were originated during the 1959 season from the Arvin-Edison potato growing areas during the comparatively short period of 2 weeks. The tests did not include the very early or the late White Rose potatoes from other growing areas in California. Because there are often marked differences in quality of potatoes grown in the other areas and harvested either earlier or later in the season, consideration should be given to the initiation of additional test shipments which would include potatoes from the very early and very late production areas.

Since the test shipments arrived within a 2-week period at seven widespread terminal markets the research workers who were meeting these shipments did not have enough time to follow up the shipments after inspecting them on arrival and make adequate studies in the retail stores.

Because this study included only those materials and operations which were likely to be affected by the use of one or the other package, equipment costs, depreciation, taxes, interest, insurance, and other overhead and fixed costs were not determined.

DESCRIPTION OF PACKAGES

Paper Bags

The paper bags each had a capacity of 10 pounds of potatoes and were constructed of double-layer, 50-pound wet strength kraft paper with a mesh window. The bags measured 7-5/8 x 4-5/8 x 16-5/8 inches and were ventilated by sixteen 1/4-inch holes (fig. 1). They were closed with six-ply cotton twine stitched across the top of the bags with semiautomatic sewing machines.

Polyethylene Bags

Each polyethylene bag also contained 10 pounds of potatoes. The bags were constructed of 2-mil (0.002-inch) polyethylene film, and ventilated by thirty-two 1/4-inch holes. The gusseted bags measured 8 x 3 x 20 inches (fig. 2). They were closed manually with paper-covered wire--called "twists"--measuring 1/4 x 3-1/2 inches. The master baler bags, each having a capacity of five 10-pound polyethylene bags, were constructed of double-layer, 60-pound wet strength kraft paper, perforated with twenty-four 3/8-inch ventilation holes. These baler bags measured 13 x 7 x 37 inches and were closed manually with 16-gage wire ties, cut to 9-inch lengths.

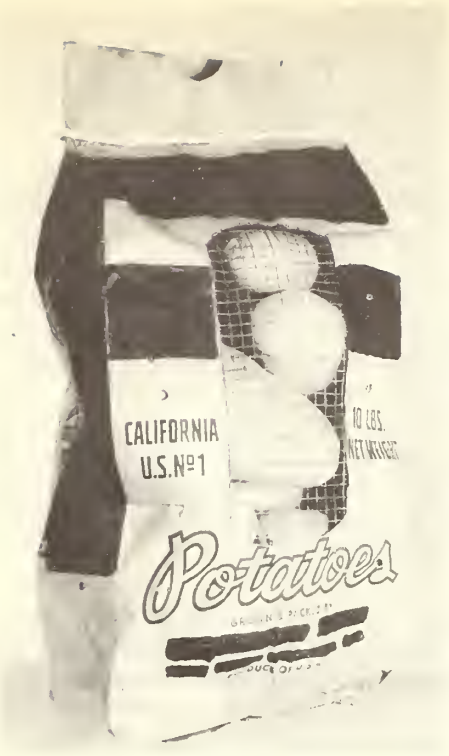

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Figure 1.--Kraft paper bag with mesh window is packed with 10 pounds of California White Rose potatoes.

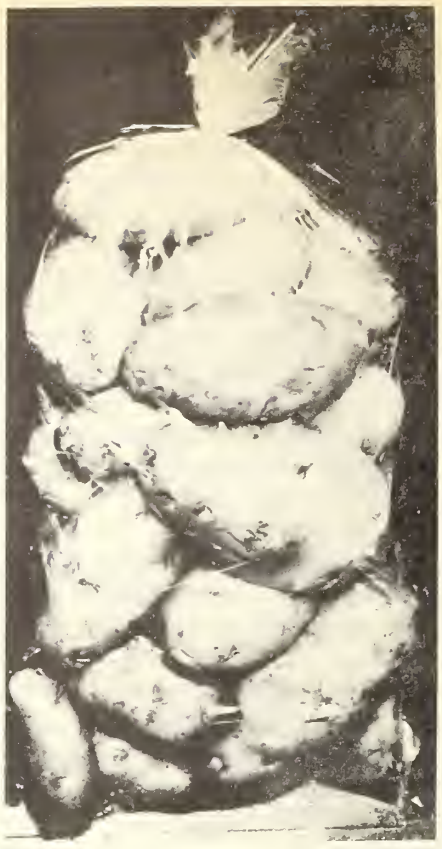

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Figure 2.--Polyethylene bag packed with 10 pounds of potatoes. Note clarity of 2-mil film.

COST OF PACKAGES AND LOADING MATERIALS

A breakdown of the cost of materials for the 10-pound paper and polyethylene bags is shown in table 1. Also included are the costs of the master paper baler used with polyethylene bags and the corrugated paper used as floor pads in the loading of the paper bags. The cost data are based on quotations received from the packers and manufacturers. The cost of packaging materials, including the corrugated paper and the master baler bags, amounted to $159.49 for a conventional carload of potatoes in paper bags and $171.05 for potatoes in polyethylene bags (table 1). The additional material cost when polyethylene bags were used amounted to $11.56 per carload (4,100 bags) or 2.8 cents more per 100 pounds of potatoes.

Table 1.--Comparative costs of materials for packing California White Rose potatoes in 10-pound mesh-window paper bags and 10-pound polyethylene bags, California shipping points, June 1959 1/

Materials	Paper bag with mesh window		Polyethylene bag	
	Per 1,000 bags	Per carload of 4,100 bags	Per 1,000 bags	Per carload of 4,100 bags
	Dollars	Dollars	Dollars	Dollars
Consumer bags	37.70	154.57	24.40	100.04
Twine for closing	.30	1.23	---	---
Wire twists for closing	---	---	.52	2.13
Baler bags	2/	---	3/16.26	66.67
Wire ties for closing	2/	---	3/.54	2.21
Loading materials:				
Corrugated roll paper	.90	3.69	---	---
All materials, total	38.90	159.49	41.72	171.05

1/ Materials costs based on carload quantity, delivered to Bakersfield, Calif.

2/ Paper bags were not packed in a master container but were loaded loose in the railroad cars.

3/ Cost based on five 10-pound bags per master baler.

METHODS OF PACKING AND LOADING POTATOES

In Paper Bags

In each plant similar methods were employed to fill, close, and load the 10-pound paper bags. The methods of performing the various operations, as observed in three plants, are described below.

Filling

Method 1: Manual, 2 heads.--One plant used sliding-gate filling heads, similar to those used in filling 100-pound bags. After filling one bag at the first head, the operator diverted the flow of the potatoes to the second head with the aid of a sliding gate. The operator then removed the full bag from the first head, placed it on a conveyor belt, and attached an empty bag to the head.

Method 2: Semiautomatic, 1 head.--Two packing plants used semiautomatic scoop heads. A conveyor belt carried the potatoes from the main belt directly into the scoops (fig. 3). When the weight in the scoops reached 10 pounds 8 ounces, a gate automatically closed and the direct-flow belt from the main table stopped. The operator then filled the bag by tilting the scoop (fig. 4). The scoop fell back into normal position, the gate reopened, and the belt started the flow of potatoes directly into the scoop again. The filled bag was then placed on a conveyor belt.

Weighing and closing

Except in the plants using scoop heads, all weighing was done manually. The bags were removed from the conveyor and placed on an over-and-under scale. The operator then adjusted for weight and returned the bags to the conveyor.

At all the plants studied, the bags were closed with cotton twine by semiautomatic sewing machines.

Loading

Two-wheel handtrucks were used to move the bags from the packing line to the railway cars. Each truck held thirty-two 10-pound bags. The bags were individually loaded in railroad cars in a 12-high, 11-wide, solid load. Corrugated roll paper was placed between the floor rack of the car and the bottom layer of bags.

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Figure 3.--Main conveyor belt carries potatoes to semiautomatic scoop filling heads.

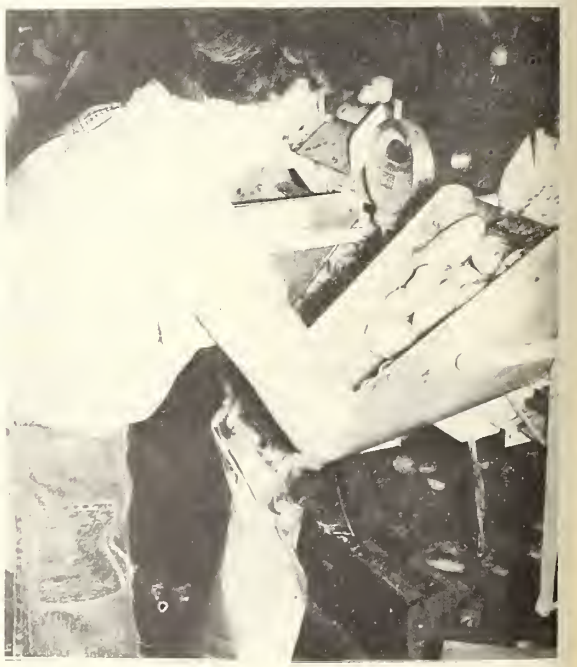

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Figure 4.--Semiautomatic scoop filling head is emptied into polyethylene bag.

In Polyethylene Bags

The polyethylene bags were not packed commercially in the plants studied. For these tests the polyethylene bags were filled by regular workers on the same lines that were used for the paper bags. The polyethylene bags were closed and loaded manually by the research workers.

Instead of stitching the bags, the filled polyethylene bags were removed from the regular packing line and closed manually by gathering the top of the bag and twisting a wire around the gather. After they were closed, the polyethylene bags were placed into paper master balers; each master held five 10-pound bags. The master balers were closed with wire ties, and manually handtrucked, six master balers per handtruck, into the railway cars. The master bags were loaded 6 high, 4 wide, with 3 crosswise, and 1 bag lengthwise, against the sidewall--the sidewall locations of the lengthwise bags were alternately reversed by layers (fig. 5).

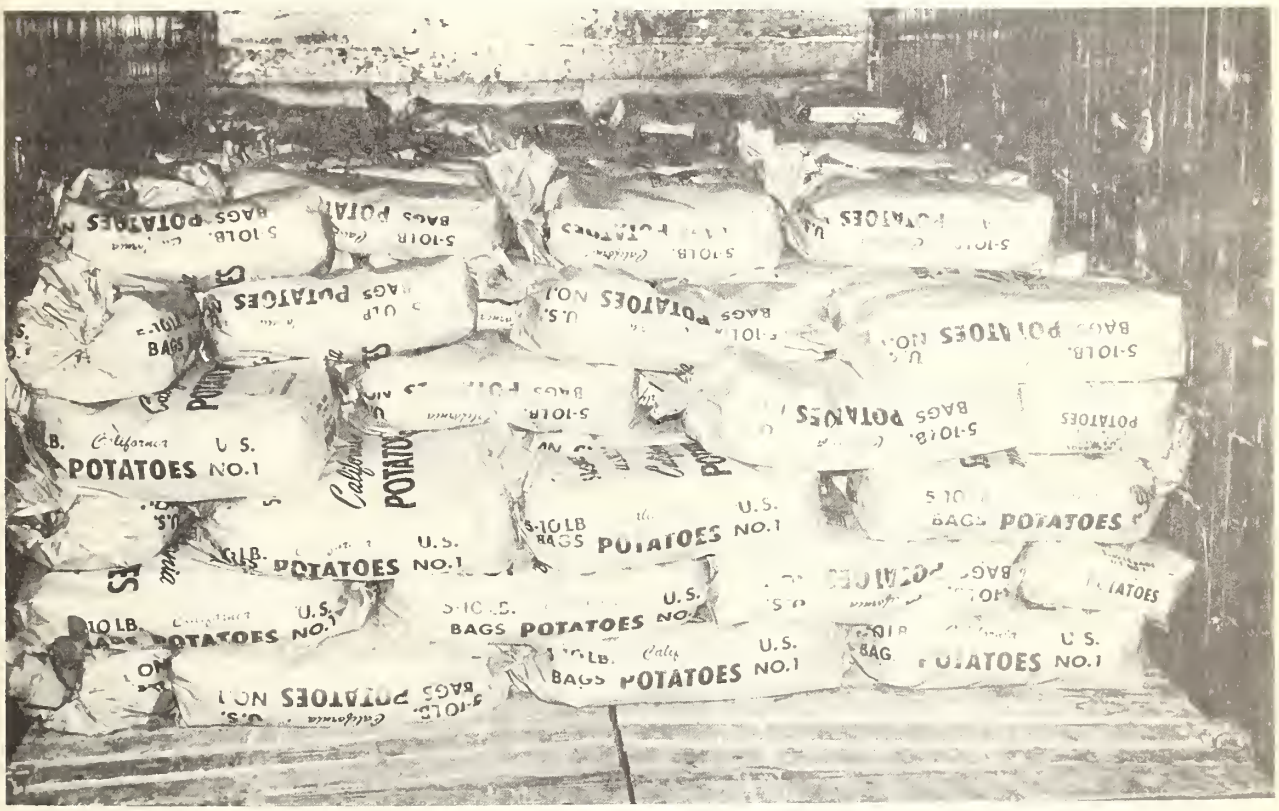

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Figure 5.--Cross section view of railway car loaded with paper master containers; each container holding five 10-pound polyethylene bags.

REQUIREMENTS AND COST OF DIRECT LABOR FOR PACKING AND CARLOADING POTATOES 3/

Labor Requirements

Time studies were conducted in three potato plants that were packing 10-pound paper bags. Table 2 shows the average amount of direct labor used for packing and loading 100 pounds of potatoes in 10-pound paper bags, as well as estimates of direct labor that would be required for packing and loading 10-pound polyethylene bags. The labor requirements for the polyethylene bags are based on the times developed for the paper bags and not on actual observation.

Packing 100 pounds of potatoes in the paper bags required .70 man-minute less than packing them into polyethylene bags which in turn were packed in baler bags for shipment. This advantage, however, was reduced to .20 man-minute by the faster loading of the master balers containing the film bags. The paper bags had to be loaded individually, and the floors of the rail cars had to be padded with corrugated paper which was not needed in the cars loaded with master balers.

Table 2.--Direct labor for packing and loading 100 pounds of potatoes: Actual requirements when potatoes are packed in 10-pound paper bags, and estimated requirements when potatoes are packed in 10-pound polyethylene bags and in master balers, California shipping points, June 1959 1/

Operation	Paper bags (average for 3 plants)	Polyethylene bags (hypothetical data)
	Man-minutes	Man-minutes
Filling	1.60	1.60
Weighing	1.00	1.00
Closing	.40	2/.40
Packing and closing master balers 3/	---	2/.70
Loading	1.50	1.00
Total	4.50	4.70

1/ Allowance made for 5 percent personal time, and 15 percent fatigue time.
2/ Based on closing the polyethylene bags and their master containers with semiautomatic and automatic machinery.
3/ Five polyethylene bags are packed in each master baler.

3/ Thomas D. Reinbold, industrial engineer, Transportation and Facilities Research Division, Agricultural Marketing Service, conducted the time studies and assisted in the preparation of this section of the report.

Labor Costs

Direct labor costs for packing and loading are based on total man-minutes required at an assumed hourly wage of $1.50. The average cost of direct labor for packing and loading 100 pounds of potatoes was 11.25 cents when 10-pound bags are used and 11.75 cents when 10-pound polyethylene bags are used.

COMBINED COSTS OF MATERIALS AND DIRECT LABOR

Table 3 shows the cost of direct labor and materials for the 10-pound paper bags and the 10-pound polyethylene bags.

The average costs of labor and materials to pack and load 41,000 pounds (1 carload) amounted to $205.61 for the paper bags and $219.23 for the polyethylene bags--3.3 cents more per 100 pounds of potatoes packed in polyethylene bags.

Table 3.--Costs of materials and direct labor used for packing White Rose potatoes in paper and polyethylene bags at California shipping points, June 1959

Item	10-pound paper bags		10-pound polyethylene bags	
	Cost per 100 pounds of potatoes	Cost per carload (41,000 lbs.)	Cost per 100 pounds of potatoes	Cost per carload (41,000 lbs.)
	Dollars	Dollars	Dollars	Dollars
Direct labor at $1.50 per hour	0.1125	46.12	1/0.1175	48.18
Packaging materials	.3890	159.49	.4172	171.05
Total	.5015	205.61	.5347	219.23

1/ Based on hypothetical packing line (table 2).

TRANSPORTATION COSTS

Paper bags shipped loose were billed at 10.5 pounds. The billing weight for a paper master baler bag holding five polyethylene bags was 51.75 pounds. The gross billing weight was 43,050 pounds for a conventional carload of 4,100 10-pound paper bags shipped loose, and 42,435 pounds for 4,100 10-pound polyethylene bags shipped in master baler bags. This lower tare weight would result in a saving of $12.05 per carload for shipping potatoes in polyethylene bags from Kern County, Calif., to New York City (table 4).

Table 4.--Railroad freight rates for White Rose potatoes in 10-pound bags, shipped from Kern County, Calif., to New York City, by type of bags, June 1959 1/

Type of bags	Gross billing weight per carload (4,100 bags)	Total freight rate per carload (4,100 bags)
	Pounds	Dollars
Paper bags	43,050	843.78
Polyethylene bags	42,435	831.73
Difference	615	12.05

1/ Southern Pacific Company. Rates on Potatoes, Kern County. March 15, 1959, p. 4. The freight rate per 100 pounds from Kern County, Calif., to New York, N. Y., was $1.96 (40,000 pounds minimum weight).

COSTS OF PREPACKAGING AND PACKING IN BULK

The total cost of packaging materials, direct labor to package and load, and transportation charges to ship 100 pounds of potatoes from Kern County, Calif., in 10-pound paper bags was $2.56; and in 10-pound polyethylene bags with balers, $2.57. This was slightly higher than potatoes bulk-packed in conventional 100-pound burlap bags, but lower than the cost in fiberboard boxes. Comparable costs to pack and ship potatoes in the various containers are listed in table 5. Costs for the burlap bags and fiberboard boxes were developed in a previous study (see footnote 1, page 5).

EVALUATION OF POTATOES AND PACKAGES AT TERMINAL MARKETS AND RETAIL STORES

Ten test railway shipments were originated in cooperation with four grower-shippers. The test railway cars were shipped between May 28 and June 12, 1959, to the following terminal markets:

Date shipped	Market
May 28, 1959	Baltimore, Md.
May 29, 1959	Garden City, N. Y.
May 29, 1959	Maspeth, N. Y.
June 1, 1959	Baltimore, Md.
June 3, 1959	Scranton, Pa.
June 4, 1959	Cleveland, Ohio
June 6, 1959	Detroit, Mich.
June 10, 1959	Detroit, Mich.
June 11, 1959	Cleveland, Ohio
June 12, 1959	Cleveland, Ohio

Table 5.--Cost of packing materials, direct labor, and transportation per 100 pounds of potatoes, by type of container, shipped by rail from Kern County, Calif., to New York City, 1958-59

Container	Packing materials	Direct labor 1/	Trans-portation 2/	Total
	Dollars	Dollars	Dollars	Dollars
10-lb. paper bags	0.39	0.11	2.06	2.56
10-lb. polyethylene bags 3/	.42	.12	2.03	2.57
50-lb. fiberboard boxes	.57	.07	2.08	2.72
50-lb. burlap bags	.29	.04	1.98	2.31
100-lb. burlap bags	.18	.03	1.98	2.19

1/ At $1.50 per hour.

2/ Based on billing rates of The Southern Pacific Co. (Rates on Potatoes, Kern County, March 15, 1959, p. 4). Actual billing weights were: Paper bags 10.5 lbs.; 5 polyethylene bags in baler 51.75 lbs.; fiberboard box 53 lbs.; 50-lb. burlap bag 50.5 lbs., and 100-lb. burlap bag 101 lbs. Refrigeration charges not included.

3/ Includes master baler bags.

Condition on Arrival at Terminal Market

Eight of the railway test shipments were inspected upon arrival at the terminal markets. The 10-pound kraft-paper bags arrived in good condition. Except for some minor scuffing no other damage was noted. The master baler bags and the polyethylene bags which they contained likewise arrived in good condition and no damage was found.

The potatoes also were in good condition, with very little bruising and decay. The total amount of skinned potatoes, with and without discoloration, was approximately one-third more in the paper bags which were shipped individually than in the polyethylene bags that were shipped in master baler bags. An average of 52.6 percent of the potatoes in the paper bags and 35.7 percent of those in the polyethylene bags were skinned. This difference in skinning might be attributed to the following factors: (1) The polyethylene film was less abrasive than the paper bags with mesh windows, and (2) the master baler bags provided some additional protection for the potatoes in the polyethylene bags.

Skinned, not discolored.--The total amount of skinned but not discolored potatoes found was 18.8 percent in the paper bags and 33.2 percent in the polyethylene bags (table 6). This difference was statistically significant.

Table 6.--Condition of prepackaged White Rose potatoes on arrival at eastern terminal markets, 8 test shipments from Kern County, Calif., June 1959

Condition	Potatoes in 10-pound paper bags	Potatoes in 10-pound polyethylene bags
	Percent	Percent
Potatoes with no defects	45.2	62.1
Skinned, not discolored:		
Very slight	11.1	16.5
Slight	7.4	14.7
Moderate	.3	2.0
Total 1/	18.8	33.2
Skinned-discolored:		
Slight	29.0	2.5
Damage	4.7	2/
Serious	.1	0
Total 1/	33.8	2.5
Bruised:		
Slight	.3	.6
Damage	.1	2/
Serious	0	0
Total	.4	.6
Greening:		
Slight	1.7	1.5
Damage	0	0
Serious	0	0
Total	1.7	1.5
Decay	.1	.1
Weight loss 1/ 3/	4.0	.8

1/ Differences are statistically significant at the 1 percent level.
2/ Less than .05 percent.
3/ Percent of weight lost by potatoes packed in the two types of bags from time of packing to the time that they arrived at destination market, usually a 7- to 9-day period.

Skinned and discolored.--Considerably more discolored potatoes were found in the paper bags than in the polyethylene bags, probably due to higher humidity and less oxidation in the polyethylene bags. Also, the discolored areas found on the potatoes packed in the paper bags were darker than those found in the polyethylene bags. The total amount of skinned, discolored potatoes was 33.8 percent in the paper bags and 2.5 percent in the polyethylene bags (table 6). This difference was statistically significant.

Bruising.--Very few of the potatoes were bruised (table 6). Percentages of bruised potatoes found in the two kinds of packages were not significantly different from each other.

Greening.--There was no significant difference in the amount of greening of potatoes in both kinds of bags. The green areas found were usually small and well defined--less than 5/8-inch in diameter. The degree of greening recorded was slight (table 6).

Decay.--Decay was recorded in one of the paper-bag test shipments and in three polyethylene-bag test shipments at the terminal market. However, in each shipment, the decay was slight and there was no significant difference in the amounts found in the two types of bags (table 6).

In one of the test shipments, small black spots were found on the skins of both the paper and polyethylene-bagged potatoes. This was not classified as decay. It was believed that this condition was present before the potatoes were packed. This black spot was found on 5.9 percent of the paper-bagged potatoes, compared to 14.6 percent of the potatoes in the polyethylene bags.

Weight loss.--When packed, the paper bags weighed an average of 10.86 pounds and the polyethylene bags averaged 10.66 pounds. Upon arrival at the terminal markets, the bags were reweighed. The average weight of the paper bags upon arrival was 10.42 pounds, compared to 10.58 pounds for the polyethylene bags. This statistically significant difference represented an average weight loss of 7.0 ounces for potatoes packed in paper bags and 1.3 ounces for potatoes packed in the polyethylene bags. This weight loss occurred during a 7- to 9-day railway transit period (table 6).

Retailers insist that a few additional ounces over the stated net weight be packed in the bags so that they can guarantee the net weight to their customers. Weight losses found in this study indicate that packers would have to set their scales at 10 pounds 10 ounces when packing in paper bags and 10 pounds 4 ounces when packing in polyethylene bags. Setting the scales at these weights would allow the bag fillers a tolerance of 2½ to 3 ounces during filling.

Dry-packed vs. wet-packed potatoes.--Four shipments packed with dry potatoes and four shipments packed with moist potatoes were examined upon arrival at terminal markets. The results of these examinations are shown in table 7.

Potatoes packed dry in the paper bags showed a very significant increase in skinned and discolored areas. Whether they were packed wet or dry did not seem to significantly affect the condition of potatoes packed in the polyethylene bags.

Table 7.--Damage to prepackaged White Rose potatoes packed dry and packed wet, inspected on arrival at eastern terminal markets, 8 test shipments from Kern County, Calif., June 1959

Kind of damage	Potatoes in 10-pound paper bags		Potatoes in 10-pound polyethylene bags	
	Packed wet	Packed dry	Packed wet	Packed dry
	Percent	Percent	Percent	Percent
Skinned, discolored	1/28.4	1/39.2	2.2	2.8
Bruised	.4	.3	.8	.4
Decay	0	.1	.2	.1
Greening	2.2	1.2	1.7	1.3

1/ Differences in the amounts of skinning and discoloration found in potatoes packed wet and dry in paper bags were statistically significant at the 1 percent level.

Condition in Retail Stores

Paper bags from one test and polyethylene bags from three tests were inspected after they had been on display for 3 days in retail stores. The paper and polyethylene bags were still in good condition and had a fresh merchantable appearance.

Little change was found in the relative condition of the potatoes 3 days after their arrival at terminal market. Many skinned potatoes had healed over fairly well but there was still a higher percentage of slightly skinned and discolored potatoes in the paper bags than in the polyethylene bags. Slightly more greening was found in the polyethylene bags than in the paper bags. Less than 1 percent decay was found in the polyethylene bags and none was found in the paper bags. In summary, the damage found in potatoes in both types of bags was slight and did not materially affect the salability of the bags.

TRADE REACTION

Trade reaction to the potatoes prepackaged at shipping point in 10-pound polyethylene bags and paper-and-mesh-window bags was favorable.

Because the polyethylene bags were packed in baler bags, they could be unloaded faster than the paper bags which were not customarily packed in baler bags. Also, the use of baler bags made for more efficient warehousing and reloading onto trucks for delivery to retail stores.

Greening did not begin in potatoes in the polyethylene bags until they were removed from the baler bags. On the other hand, potatoes in the polyethylene bags were more subject to greening on display than those in the paper bags. However, retailers also reported greening of potatoes in conventional burlap bags if they are not properly stored or rotated. Greening did not appear to be a serious problem for retailers who properly rotated their displays and did not expose the potatoes to bright light. Retail store operators generally agreed that consumers liked the additional visibility offered by the polyethylene bags. The retailers' chief reservations were: (1) The potatoes packaged in polyethylene were more susceptible to greening than those packaged in the paper bags; and (2) if there was any decay present it usually developed faster in the polyethylene bags than in the paper bags.

TRENDS AND RECOMMENDATIONS

Practically every supermarket in the United States is now retailing potatoes in consumer packages. Much of this prepackaging is done in the retail stores and at the wholesale terminal level, but many retailers are purchasing their prepackaged potatoes directly from the production areas.

It costs more to prepackage potatoes in 10-pound bags than to pack them in 100-pound burlap bags, but prepackaging at the point of production should reduce total marketing costs. Certainly it does not make much sense for the packer to wash, sort, grade, and pack potatoes in 50- and 100-pound shipping containers only to have the same job done again at the terminal market or retail store. Labor and overhead costs are higher in the cities. The shipping containers and a certain amount of culls (which cost 2 cents a pound for transportation alone) are discarded and in some instances result in additional charges for garbage disposal. The extra handling of the potatoes results in deterioration of quality.

Some production areas are now prepackaging a significantly large percentage of their crop and this percentage is increasing. For example, it was estimated that 43 percent of the Maine crop was being prepackaged in 1958-59. Because they require careful handling, White Rose potatoes grown in California have not been prepackaged at shipping point to any great extent. The results of this study show that White Rose potatoes of good quality and condition can be prepackaged and shipped successfully to the most distant eastern markets.

The demand for prepackaged potatoes is so strong that one supermarket chain is building prepackaging plants in production areas. An eastern firm that prepackages potatoes at the terminal market went so far as to supply polyethylene bags to a Kern County packer to induce him to prepackage California White Rose potatoes. Retailing potatoes in consumer packages is now an accepted merchandising method and packers can look forward to an increased demand for prepackaged potatoes of consistently good quality.

Polyethylene bags had two distinct advantages. They provided greater visibility--much liked by buyers--and reduced the discoloring of skinned areas. However, these bags must be used with care because the higher humidity maintained within them accelerates growth of decay if the organisms are present, and the clear film permits greening unless stocks are rotated in the retail stores.

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