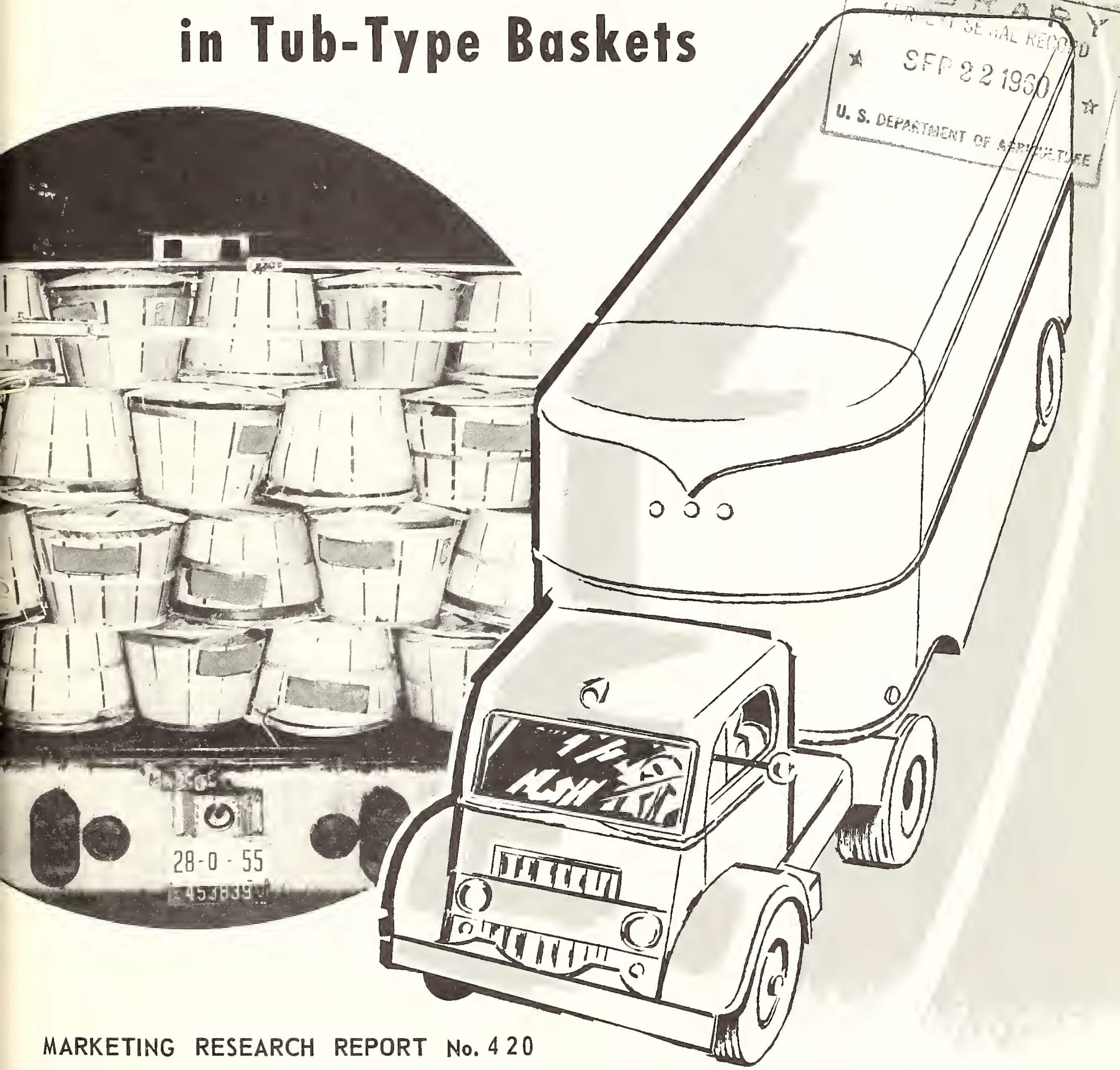
Better Loading Methods for TRUCK SHIPMENTS OF PEACHES in Tub-Type Baskets



MARKETING RESEARCH REPORT No. 420

Transportation and Facilities Research Division
Agricultural Marketing Service

UNITED STATES DEPARTMENT OF AGRICULTURE

PREFACE

Transportation and refrigeration costs account for a substantial part of the total costs of marketing peaches and other fresh fruits and vegetables. Loading methods which increase the rate of utilization of space in the vehicle provide a practical means by which the cost of these services per package can be reduced. The loading methods, however, must be consistent with proper air circulation, adequate refrigeration and ventilation, and structural and legal weight limitations of the vehicle.

This study was made to determine the feasibility of adapting the alternately inverted loading method for baskets of peaches to motortruck shipments of the fruit, so as to reduce transportation costs. The study is part of a continuing program of research to reduce costs and improve the efficiency of transportation and marketing of agricultural products.

The study was made possible by the cooperation of the American Veneer Package Association, the Fresh Products Standardization and Inspection Branch of the Fruit and Vegetable Division, Agricultural Marketing Service, and numerous peach growers and packinghouse operators, truckers, and receivers. The following individuals participated in the field research: J. O. Blalock, of Georgia Federal-State Inspection Service, and Kenneth Myers, B. P. Rosanoff, and Ronald A. Shadburne, all of the Transportation and Facilities Research Division.

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HIGHLIGHTS

Research during the 1958 and 1959 shipping seasons for Georgia and South Carolina peaches showed that the alternately inverted loading method can be used effectively for motortruck shipments of fresh peaches packed in 1/2-, 3/4-, and 1-bushel baskets. The main advantage of the alternately inverted load over the conventional upright load is that its greater density makes it possible to get more containers in the same space in the vehicle, reducing transportation and refrigeration costs per basket.

Comparison of the amount and severity of fruit bruising in inverted and upright baskets indicated that fruit bruising was not significantly increased by the loading of alternate baskets on their covers. The bruising found in both upright and inverted baskets was not localized on faces of the packs, but interspersed throughout the baskets. The fruit inspections were made by Federal inspectors at terminal markets on sample containers from the bottom layer of each test and check load, where overhead weight of the load would contribute most to fruit bruising.

The greatest increase (30 bushels) in the amount of fruit in the standard semitrailer load was achieved when the alternately inverted loading method was used for 1-bushel baskets. Increases of 18 and 25 baskets were achieved when the alternately inverted method was used for 1/2- and 3/4-bushel baskets, respectively. This would result, however, only if there were lower vehicle tare weights, higher axle loads or gross weight limits, or better distribution of weight over the axles of certain vehicles such as cab-over-engine tractor-trailer combinations. Any or all of these factors make it feasible to fill out the top layer of the load. This is in contrast to generally prevailing conditions, because permissible gross weight or axle-load limits in many areas prohibit the hauling of a maximum number of baskets in the vehicle.

Time studies of loading operations in previous research on use of the alternately inverted loading method for rail shipments of peaches showed that elapsed time required to load a given number of baskets by this method was almost the same as for the conventional upright loading method. There is no reason to believe that the time or labor requirements would be any different for truck shipments when both types of loading methods were used under identical conditions by the same loading crews.

BETTER LOADING METHODS FOR TRUCK SHIPMENTS OF PEACHES IN TUB-TYPE BASKETS

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BACKGROUND OF STUDY

Most of the fresh peaches shipped to market from producing areas in the United States are now transported in motortrucks. Tub-type veneer baskets of 1/2-, 3/4-, and 1-bushel capacities are the predominant types of containers used for the fruit, especially for shipments from the Southeast to northern markets, although a substantial volume of fruit is packed also in wirebound, fiberboard, and other types of containers. Loading of the semiconically shaped baskets in trucks by the conventional upright method produces light-density loads, resulting in poor utilization of loading space in the vehicle.

Previous research had disclosed that the crosswise-offset alternately inverted method of loading could be effectively used for rail shipments of peaches in baskets. It not only reduced container damage by more than 50 percent, but also permitted loading of more baskets in a refrigerator car, thereby significantly reducing the cost per basket of transportation and refrigeration 1/. That research prompted requests from peach shippers and truckers for similar research to determine if the alternately inverted loading method might be advantageous also in truck shipments of peaches in baskets.

In contrast to rail shipment, truck shipment of peaches in baskets results in only negligible damage to containers. This is because there is little or no lengthwise shifting of the load--the principal cause of damage in rail shipments.

The baskets are normally stacked to greater heights in truck shipments than in rail shipments, particularly at the rear of the vehicle, where vertical vibration is considerably greater than in other areas of the trailers or in rail shipments. The only major problem in this study was to learn whether the higher stacking of baskets and the greater frequency and severity of vertical vibration in transit would result in more fruit bruising in inverted baskets in truck shipments than in upright baskets.

This report presents the results of research carried out during the 1958 and 1959 seasons with truck shipments from Georgia and South Carolina to northern markets.

Methods of Obtaining Test Data

Preliminary tests were run in 1958 to familiarize the personnel conducting the study with prevailing trade practices and truck loading and transportation methods, and to develop information required for planning the 1959 test shipments.

1/ Shadburne, R. A., Improved Loading of Baskets of Peaches and Fresh Prunes in Railroad Cars, MRR No. 275, September 1958.

Shipping tests conducted during the 1959 season consisted of 31 test and 19 control shipments of all 3 of the usual sizes of baskets. To the extent possible, the test and control loads were set up on a paired basis with fruit of the same variety packed at the same packinghouse and shipped in the same type of vehicle to the same market. However, many of the test and control shipments were made without definite destinations, others were diverted from their original destinations while in transit, and some arrived at markets when Federal inspection offices were closed, or were unloaded before the Federal inspector arrived. Both test and control shipments were made with fruit of U. S. No. 1 quality and condition as determined by Federal-State inspection at the packinghouse. The first paired shipments were originated at Cordele, Ga., and the last pair in the area of Spartanburg, S. C. The shipments terminated at markets in Massachusetts, New Jersey, New York, Ohio, and Pennsylvania. Destination inspections of the shipments were made by Federal inspectors on a total of 25 loads; however, inspections were complete, for all load locations, for only 7 alternately inverted test loads and 11 conventional upright control loads.

Two types of loading methods were studied in 1959: The conventional upright crosswise-offset method, in which all baskets are loaded upright; and the alternately inverted method, in which alternate baskets are loaded upside down. Descriptions of the two loading methods follow.

Conventional Upright Crosswise-Offset Method

The loading pattern described here applies to the 1/2-, 3/4-, and 1-bushel baskets. The first stack (fig. 1 and footnote 2), loaded crosswise of the truck, is begun by placing the first row (fig. 2-A) of baskets upright on the floor directly in front of the bunker wall of the trailer from sidewall to sidewall in tight contact with each other and the bunker wall. The second layer of the first stack is begun by centering a basket over the two end baskets in the bottom layer and then completing the row; thus, the two end baskets of the second layer have a space equal to about half the top diameter of the baskets between them and the sidewalls. The third layer is loaded exactly like the bottom layer, and the fourth layer is the same as the second.

In the bottom layer, four baskets of the second stack (fig.2-B)are centered tightly between the baskets in the first row. Upon completion of the row, there is usually a space equal to about half the top diameter of a basket between the end baskets and the sidewalls. The second layer of five baskets in the second stack are loaded from sidewall to sidewall in tight contact with each other and the baskets of the first stack. Each basket of the second layer rests equally on two baskets in the bottom layer, except the two end baskets, which have an

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2/ Definitions of loading terms (see fig. 1):

A row is a line of containers extending lengthwise of the truck, 1 container in width and as high as the load itself. Because of the lengthwise offset loading of the baskets, the rows are not well defined.

A layer is a course or stratum of containers one container high, usually extending the length and width of the truck.

A stack is a pile of containers extending from one sidewall to the other and from the top to the bottom of the load, parallel to the end of the vehicle, and one container in length.

overhang equal to about half the top diameter of a basket. Odd-numbered layers of each stack are identical to the bottom layer and even-numbered layers of each stack are the same as the second layer.

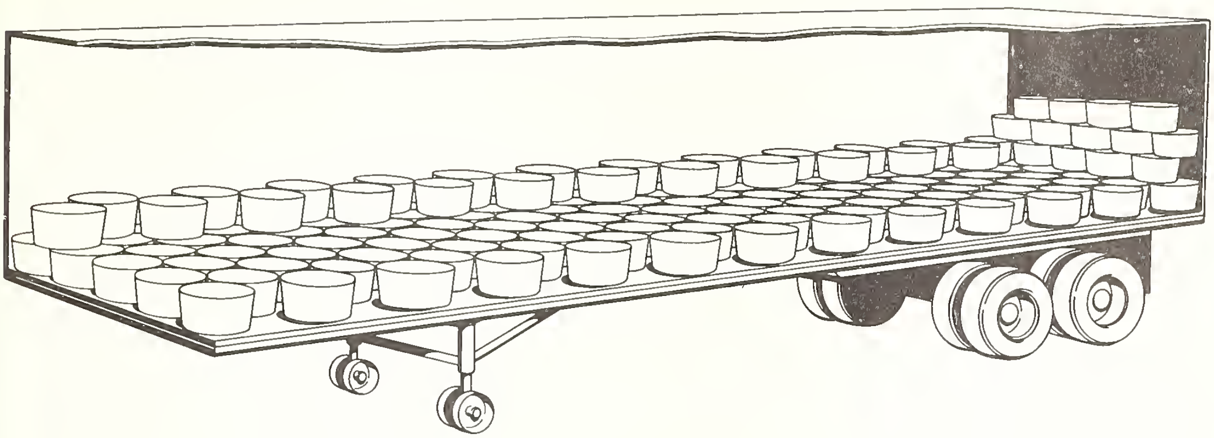

Figure 1.--Side view of a conventional upright load in a motortruck semitrailer, showing arrangement of tub-type veneer baskets in rows, stacks, and layers.

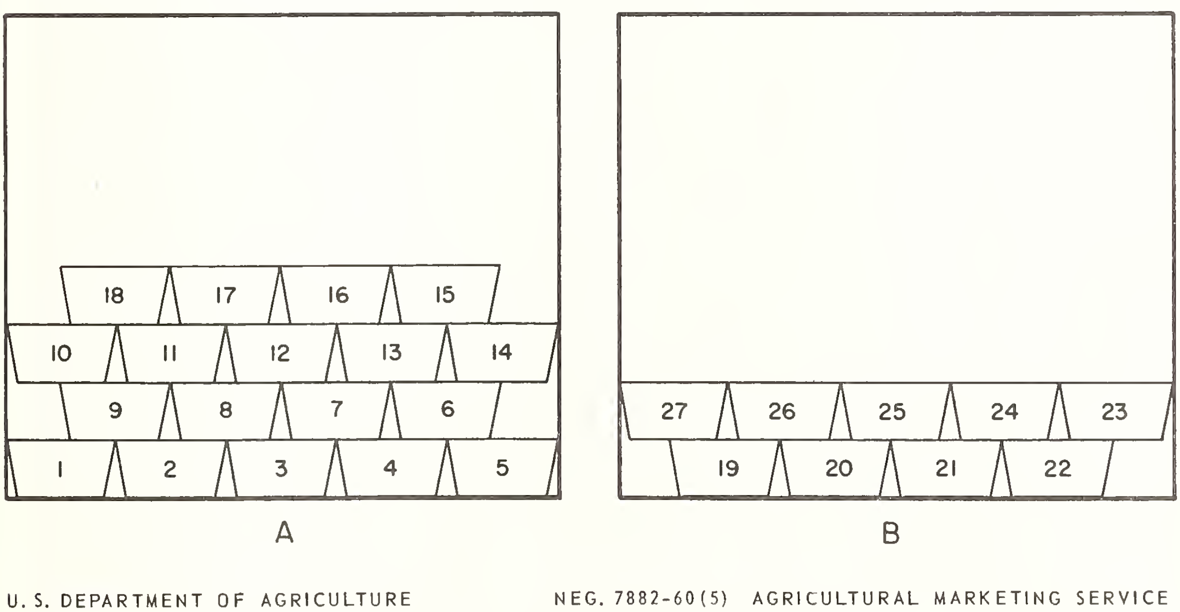

Figure 2.--Conventional upright loading pattern: (A) First stack, five baskets tight against each other and bunker wall. Baskets are placed in position in sequence with the numbers. (B) Second stack, four baskets tight against each other and first stack. Note how baskets 19 - 22 are centered between baskets 1 - 5 of first stack.

All odd-numbered stacks are loaded the same as the first stack; all even-numbered stacks are identical with the second stack. Figure 3 shows the last stack at the doorway of the trailer. This stack is even-numbered, with fewer baskets in its bottom layer than in the preceding odd-numbered stack partly visible in the background.

There are several variations of this loading method, but all follow the same general pattern.

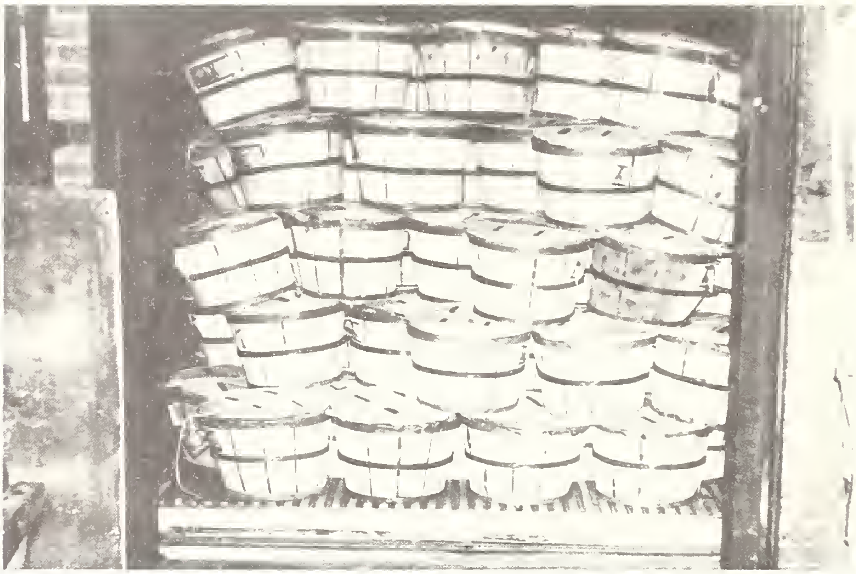

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Figure 3.--Doorway view showing how the baskets are loaded and the arrival condition of a conventional upright load at destination. Note the wracked condition of the baskets along the sidewalls.

Alternately Inverted Crosswise-Offset Method

The loading pattern described here applies to the 1/2-, 3/4-, and 1-bushel baskets. The first row is begun by placing a basket upright in either the right- or left-hand corner of the trailer against the bunker wall. To conform with the photos used as illustrations, the left-hand corner is used in this description. The second basket is inverted (turned upside down) with each alternate basket treated in the same manner (fig. 4-A) until the first line across the trailer has been completed. All baskets should be in tight contact with each other and with the bunker wall. The second stack (fig. 4-B) is begun by placing the first basket in the right-hand corner upside down tight against the right sidewall and the bottom layer of the first stack. This is the beginning of what is commonly called the step-down method of loading the baskets in alternately inverted pattern. The next basket is placed upside down in the right-hand corner against the bunker wall; this starts the second layer (fig. 4-C) of the first stack. The two rows (fig. 4-D) are completed simultaneously by alternately inverting the baskets. This procedure is carried on (figs. 4-E and 4-F) until the desired number of layers has been attained.

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Figure 4.--Construction of the alternately inverted load: (A) Step 1: First row placed tight against end wall. (B) Step 2: First layer of stack in place and the beginning of the second stack. (C) Step 3: Placement of the first basket in the second layer of the first stack. Note the step pattern of the baskets. (D) Step 4: The completed second layer of first stack, and bottom layer of second stack. (E) Step 5: First basket in place in third layer of first stack, in second layer of second stack, and in bottom layer of third stack. (F) Step 6: First basket in place in fourth layer of first stack, in third layer of second stack, in second layer of third stack, and in bottom layer of fourth stack.

Figure 5 shows how the load looks when completed. The load shown in figures 4-A to 4-F is the same as that shown in figure 5.

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Figure 5.--Rear view of alternately inverted load at origin. Note how the load locks are placed.

Test Procedures

An "origin loading report" completed by project personnel provided the following information on each test and check shipment: Origin, consignor, destination, consignee's name; date, time of shipment, and estimated time of arrival at destination; type, dimensions, size, and condition of containers; load pattern, number of load locking devices 3/ used, count, and weight; outside temperature; type, condition, and protective service of the trailer; and name of the driver.

Condition inspections by the Federal-State Inspection Service at origin provided information on the variety, size, and grade of fruit, and pulp temperatures at time of loading.

At destination, personnel of the Transportation and Facilities Research Division developed and recorded information on protective services used in transit, outside and commodity pulp temperatures, load condition, shift and slack, types of containers; condition, location, and apparent cause of container failure; and trade acceptance of the loads.

Inspection of fruit at destination was made by personnel of the local offices of the Fresh Products Standardization and Inspection Branch, Fruit and Vegetable Division, Agricultural Marketing Service. The inspectors took samples from three locations in the bottom layer. In the conventional upright loads, the inspectors took one sample basket from a stack in each of the following locations: Rear dooway, half-length of the trailer, and bunker, or first stack at front of load. Paired sample baskets (one upright and one inverted) were taken from the same locations in the alternately inverted loads. Information on variety, size, grade of fruit, pulp temperature, and bruising was recorded on the destination inspection report by the inspectors.

In comparing the alternately inverted load with the conventional upright load, the amounts of fruit bruising in each type of load are a primary consideration. Peaches are characteristically tender and susceptible to bruising, and

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3/ Load locking devices are adjustable, commercially available, tubular rods, or home-made combination wood-and-metal bars, which can be locked into place against the rear face of the last stack in the load to prevent backward shifting.

require careful handling through all phases of the packinghouse operation, transportation, and marketing, to hold fruit injury to a practical minimum. The stage of maturity for peaches when packed for shipment is generally hard ripe to firm, with a few firm ripe.

Some fruit bruising occurs during transit, but other factors prior to loading contribute to the total found upon arrival of shipments at terminal markets. Bruising may occur in any one or all of the following preloading operations: (1) Handling of fruit from orchard into the packinghouse; (2) grading and sizing operations; (3) packing and lidding operations, including pressure to which the fruit is subjected, especially in overpacked baskets; (4) unnecessary roughness in loading, such as dropping, throwing, or shoving the baskets into place. These conditions vary from one packinghouse to another and for the same shipper during the same season.

Because half of the baskets in each of the alternately inverted loads are in the same upright position as they are in the conventional upright loads, a direct comparison of bruising between the upright baskets in the two types of loads was possible when comparisons of the test and check loads were made. Each test load and corresponding check load consisted of fruit from the same orchard. This fruit was of the same general maturity, packed by the same packers, and loaded into the same trailer by the same loading crew at the same packinghouse. Therefore, the alternately inverted loads provided ideal circumstances for comparison of fruit bruising in the upright versus the inverted baskets under controlled conditions.

The inspections for bruising were restricted to fruit in undamaged baskets, as severely damaged baskets are rarely found in truck shipments. The purpose of these inspections was to determine whether inverting the baskets would cause any appreciable increase in fruit bruising in otherwise undamaged baskets.

Compression tests were conducted in 1956 on empty bushel baskets, one inverted and one upright, in a container laboratory to determine the comparative resistance of the baskets to overhead pressure. The tests showed that when the covers of the baskets were securely fastened at all four points, they could withstand slightly greater pressure before deflection when placed in an inverted position than when loaded upright. The results of these tests and of previous research on the alternately inverted loading method for rail shipments suggested that the same load might be adapted to truck shipments of the fruit with little or no increase in fruit bruising compared with the conventional upright method.

RESULTS

The data on fruit bruising developed in the destination inspections of sample baskets from the bottom layers of the test and check loads are shown in figures 6 to 11. A comparison of total fruit bruising in the alternately inverted and conventional upright loads of all three sizes of baskets is shown in figure 6. Figures 7, 8, and 9 present a comparison of fruit bruising found in the inverted and upright baskets in alternately inverted loads of 1-bushel, 3/4-bushel, and 1/2-bushel baskets, respectively. Bruising data shown in the three figures are recapitulated for all sizes of baskets in figure 10. Bruising data for the control loads, in which all baskets were loaded in the conventional upright pattern, are shown in figure 11.

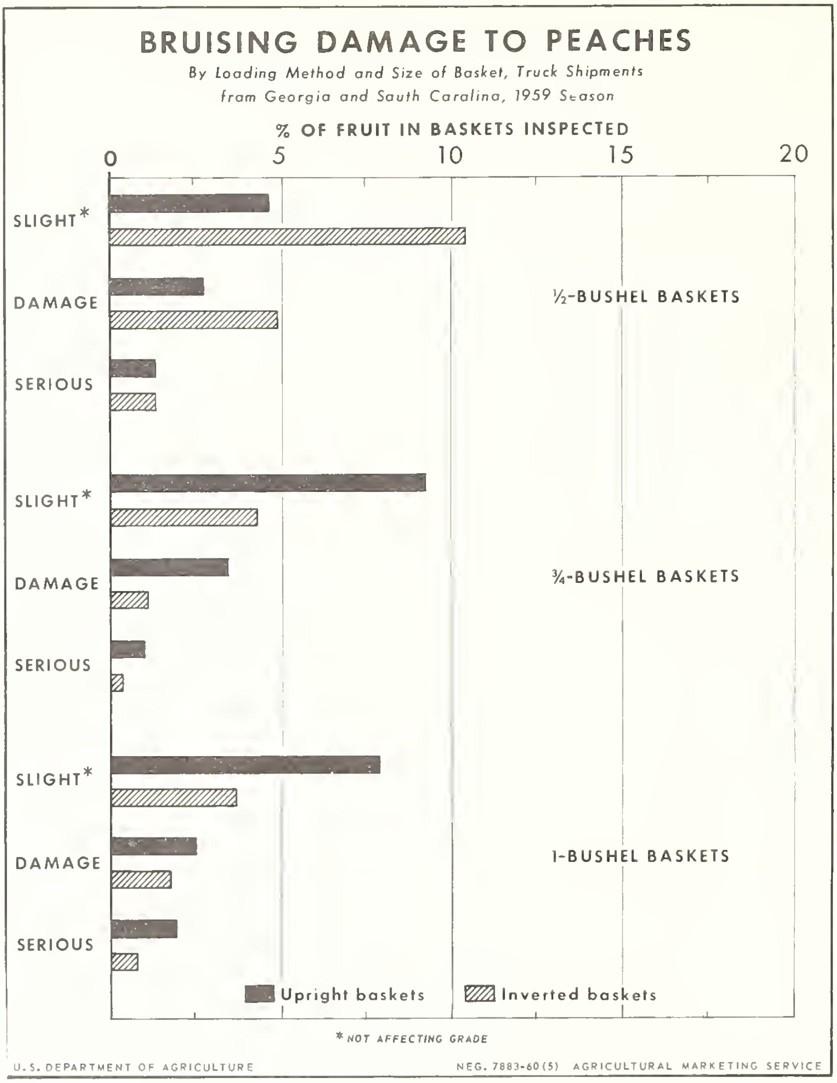

Figure 6

Although fruit samples in a total of 25 alternately inverted and conventional upright loads were inspected by Federal inspectors immediately upon arrival of the loads at destination markets, inspection reports were complete for baskets in all comparative load locations for only 7 of the alternately inverted and 11 of the upright loads. The fruit bruising comparisons in figures 6 to 11 are based on only those shipments in the three sizes of baskets on which fruit samples from all locations in the loads were inspected. Comparison of the fruit bruising found in loads of each type in which samples from only one or two load locations were inspected shows results about the same as those presented in the accompanying charts.

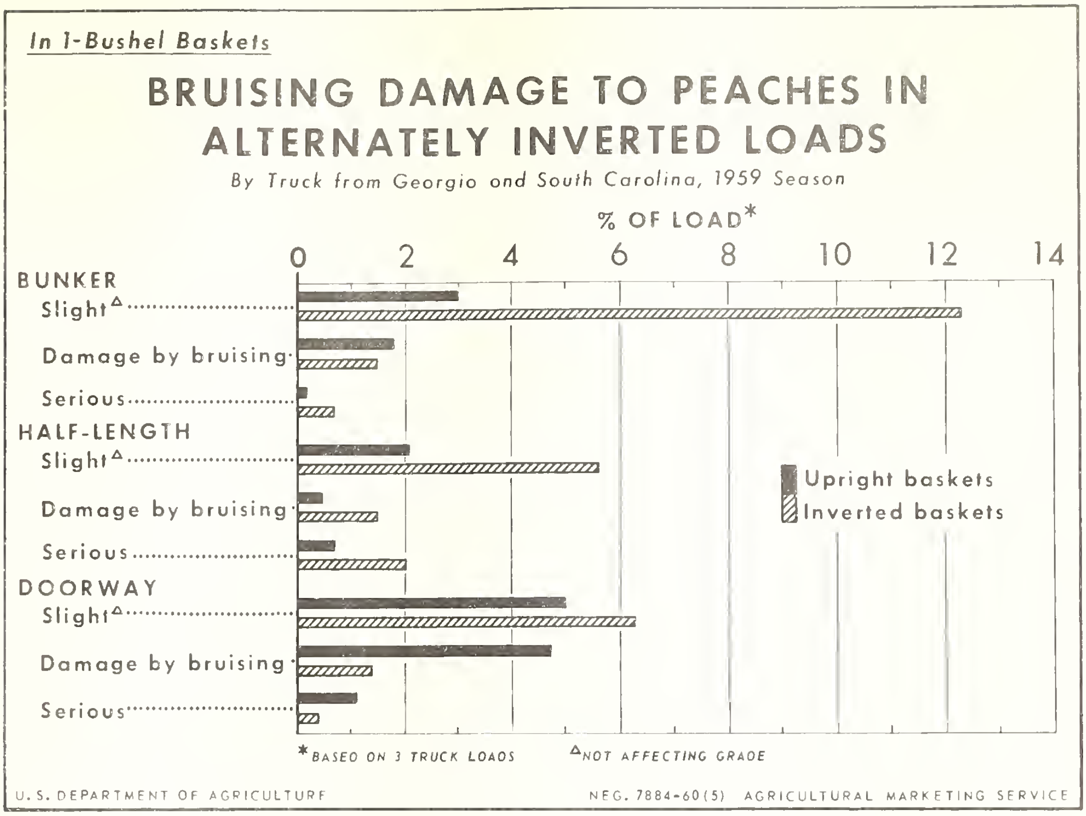

Figure 7

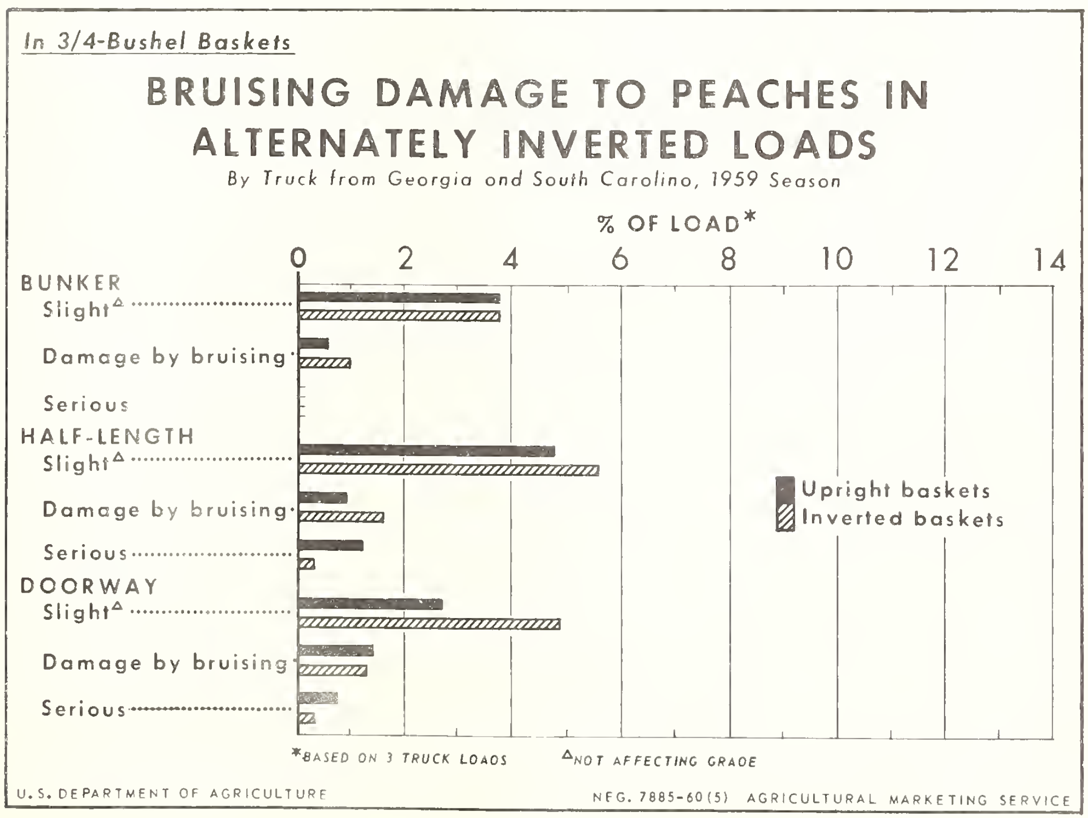

Figure 8

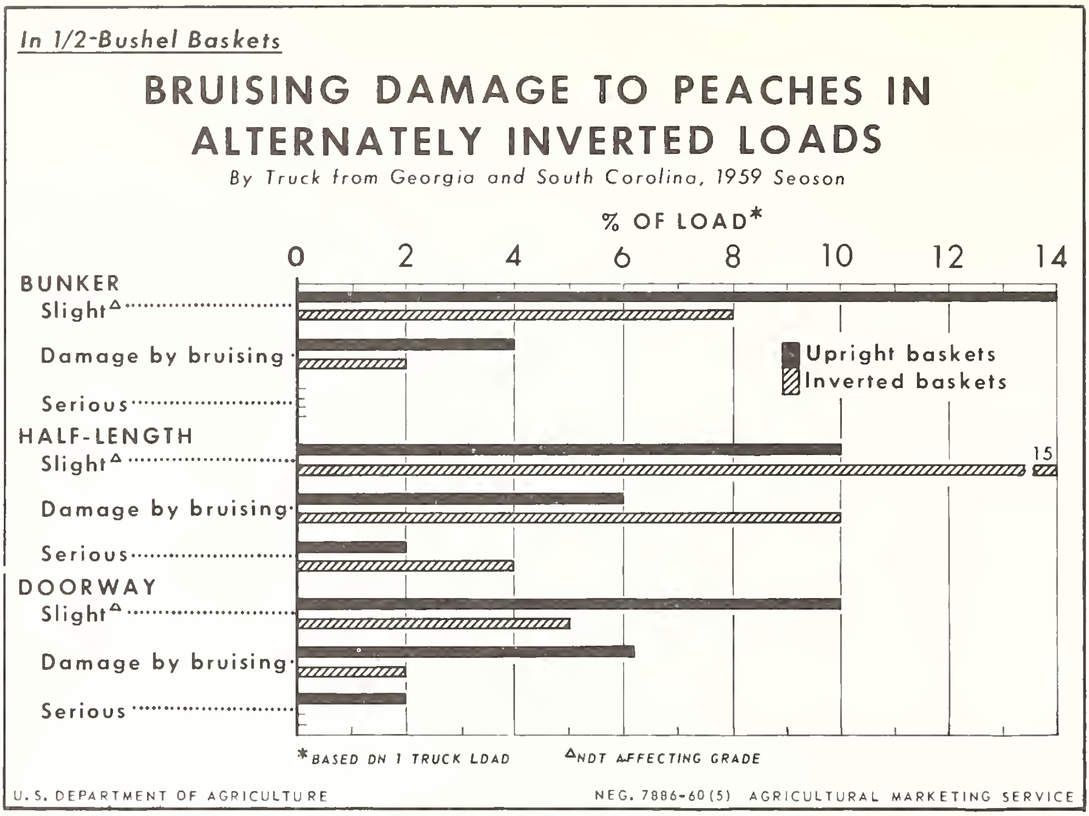

Figure 9

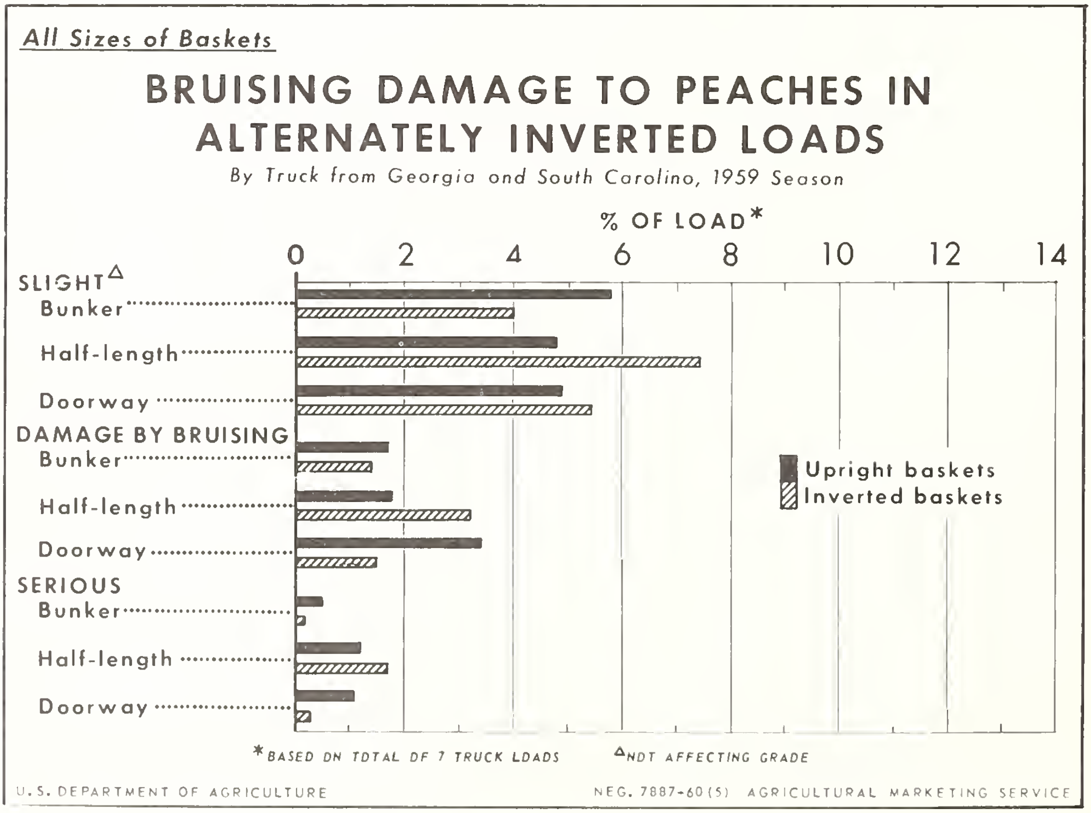

Figure 10

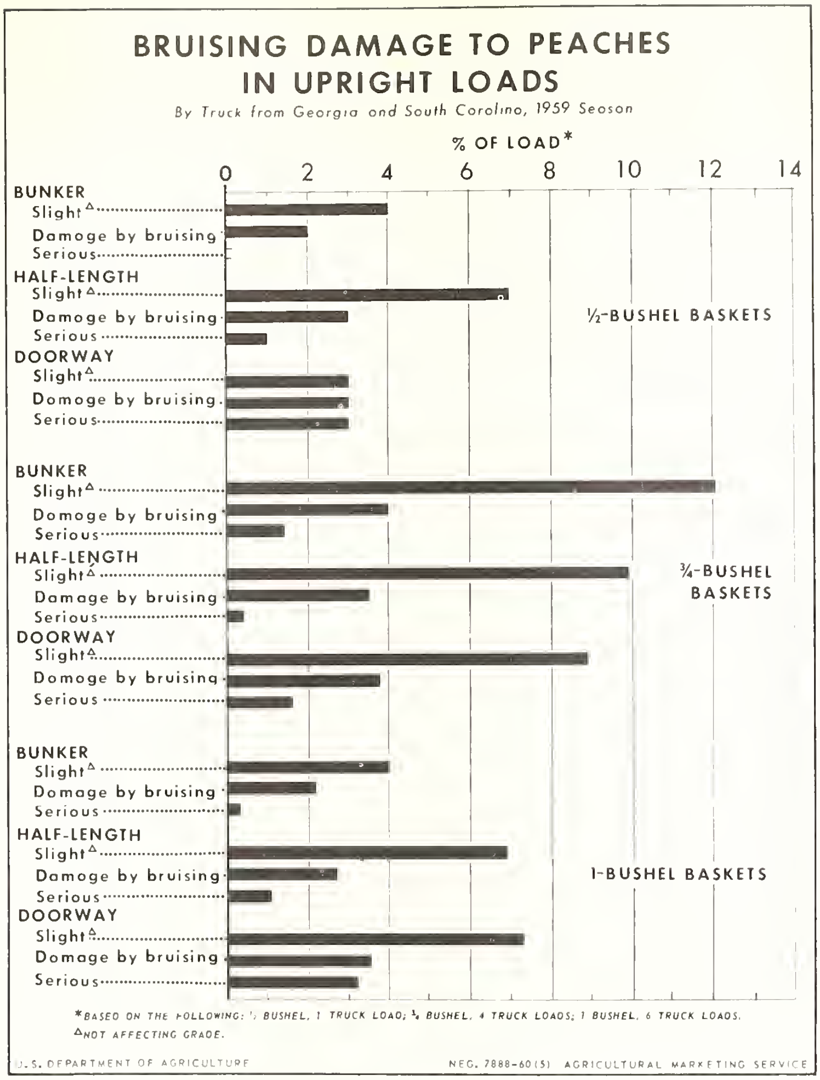

Figure 11

Extent of Fruit Bruising

Fruit bruising information developed in these inspections was classified by the same degrees of severity used in the Federal inspection reports for fruit grading and trading purposes. Because the first category of damage, slight bruising, does not affect the grade of the fruit and because much of this type of damage is caused by nontransportation factors such as tight packing, lidding, and rough handling, this minor bruising is of little importance in measuring the effect of loading methods on the fruit. The data show that the differences in the amount of fruit bruising between the upright and the inverted baskets were not great, nor were the variations consistent in the different degrees of damage or in the different sizes of baskets in different load positions lengthwise of the trailer.

The comparison between the two types of loads in figure 6 shows that the alternately inverted loads of 1/2-bushel baskets had more slight bruising and damage by bruising than the conventional upright loads. In the serious bruising category, however, the amount of damage was the same. Comparisons for 3/4- and 1-bushel baskets show that the alternately inverted loads consistently averaged less fruit damage in all three bruising classifications than the conventional upright loads.

The amounts of bruising in the upright and inverted baskets in the alternately inverted loads, on the basis of baskets in all three positions in the loads, are compared in figures 7, 8, and 9. The findings show that there was no consistent variation from one degree of damage to another and no significant difference between the upright and the inverted baskets in any one position. These comparisons indicate that inverting the baskets did not cause any appreciable increase in fruit bruising, even in the bottom layer of the load where damage caused by overhead weight could normally be expected to be the greatest.

The Federal inspectors were instructed to indicate the location of fruit bruising within the baskets at destination. In almost all instances, the inspectors reported that bruising in both upright and inverted baskets in the alternately inverted loads and in the upright baskets in the conventional loads was distributed throughout the packs. The fact that the bruising in the inverted baskets was not localized in the faces of the packs, where it could be expected to occur as a result of overhead weight, also indicates that inverting every other basket in the load did not increase the amount of fruit damage.

Previous research, in which the fruit in several hundred baskets was inspected, revealed that one of the major causes of fruit bruising, regardless of the loading method, was the packing of peaches of nonuniform ripeness in the same baskets. Observations in test shipments by truck in this additional research also showed that most serious bruising was caused by the pressure of hard ripe fruit in the packs against soft ripe fruit. It was observed further that such damage was distributed throughout the baskets and not localized in the faces of the packs.

Both the new and the previous research and observations of the amount of fruit bruising at destination markets caused by nontransportation factors indicated that it is feasible to load peaches packed in all three sizes of baskets by the alternately inverted loading method for truck shipment, without significant risk of fruit damage. Care in grading, packing, lidding, and loading of the baskets can further reduce fruit bruising in all baskets.

Locations of Bruising in Load

Load disarrangement, damage by bruising, and serious damage by bruising to the peaches in transit were found to be somewhat more prevalent at the front end of the tandems and on the overhang behind the tandem axles than in the middle of the load. It is in these areas that most of the force of the vertical impacts from the trailer passing over rough spots in the highway is concentrated. Generally, the two top layers of the load had a tendency to shift toward the front of the trailer, while the bottom layers shifted toward the rear. This container movement within the load is the same as that found in test shipments by truck of apples and other commodities in fiberboard containers. The movement, or shifting, described was not found in loads where load-locks and other similar load-securing devices were used.

Number of Baskets in Relation to Load Pattern

The different numbers of baskets in the conventional upright and alternately inverted loads for each of the three sizes of baskets are shown in table 1. These data are for a standard semitrailer with an inside length of 32 feet, of the type most used in this study.

The comparison in table 1 is set up on the following two bases: The typical loads used in the test and check shipments, and the maximum number of baskets that can be loaded into a trailer of the same size, allowing adequate space for air circulation in the vehicle to insure proper refrigeration. It was impossible to load shipments to the maximum height throughout the length of the trailer because of weight limitations of one or two States through which the shipments moved. For the shipments to be within the axle load limits, almost all loads had to have a partial, or incomplete, top layer in the rear half of the trailer over the tandem axles. The maximum numbers of baskets shown on the bottom line of table 1 are for a full load. Use of loads of this size are feasible under any of the following conditions: (1) When shipments are made from, to, and through States with higher gross weight and permissible axle load weights, (2) shipments made with lightweight tractors or tractors of such design (for example, cab-over-engine) that permit a greater part of the weight to be carried on the driving axle, while keeping the entire vehicle combination within gross weight and axle load limitations, or (3) shipments made in trailers pulled by tractors with dual driving axles, meeting the requirements outlined in (2) above.

The data in table 1 show that the greatest increase in the quantity of fruit carried by using the alternately inverted load, compared with the conventional upright load, is achieved when the fruit is shipped in bushel baskets. The typical load of bushel baskets would contain 30 more bushels of fruit in the alternately inverted load than in the upright load. The increase is 25 bushels in favor of the alternately inverted load when the maximum load is used. While the greatest increase in number of containers in the maximum load can be achieved when the alternately inverted pattern is used for half-bushel baskets, the increase in quantity of fruit carried is not as great as when the same pattern is used for 3/4- or 1-bushel baskets because of the differences in basket capacities.

The increases actually achieved by use of the alternately inverted pattern were not as great, nor as consistent, for the typical loads as for the maximum loads. This situation was due to the use of some trailers of varying inside lengths and widths and to differences in the tightness with which both test and check shipments were loaded.

Time Requirements by Type of Load

Time studies of loading operations, in previous research involving loading crews proficient in the use of both the conventional upright and alternately inverted methods for rail shipments, showed that the overall elapsed time was almost the same for both types of loads. The flow of baskets to the loading crews on portable wheel-type conveyors, extended into the cars, to which the

Table 1.--Comparative number of baskets in conventional upright and alternately inverted loads, by size of baskets

Basis of comparison	Size of basket								
	1/2-bushel			3/4-bushel			1-bushel		
	Upright	Alternately inverted	Difference	Upright	Alternately inverted	Difference	Upright	Alternately inverted	Difference
Typical 1/.	990	1,008	18	675	700	25	450	480	30
Maximum 2/.	1,080	1,116	36	810	840	30	600	625	25

1/ Trailer with inside length of 32 feet, with partial layer to keep load within legal weight limits.

2/ Trailer with inside length of 32 feet, solid loads, no partial layers.

baskets were transferred from a chain conveyor on the loading platform, was not constant. Actual elapsed time spent by the loading crews waiting for baskets to load ranged from 15 minutes to 1 hour per load. The amount of waiting time was not affected by the type of loading pattern used in the vehicle, but by the availability of the particular size of fruit being loaded, as several sizes of fruit were packed at the same time. Additional interruptions in the flow of packed baskets were caused by lack of fruit, mechanical breakdowns in packing-house machinery, and other delays.

The earlier study revealed that the alternately inverted loading method required 0.04 to 0.1 more man-hour of productive loading time per carload, while waiting time ranged from .5 to 2.0 man-hours. This means that when the alternately inverted loading method is used, the crew is working at a little steadier pace.

Observations by AMS personnel at shipping points showed that the flow of baskets from the packing line to the loading point, size and makeup of loading crews assigned to truck loading, and other conditions under which both test and check shipments of fruit were loaded were similar to those in the carloading study. The results of that study therefore were, in general, applicable to the loading of truck shipments. For this reason, no detailed time studies of labor requirements for both types of loads were made in this study.

Need for Supervision of Loading

Observations at shipping points in Georgia and South Carolina disclosed that an important need for improvement in loading both upright and alternately inverted loads was closer supervision of loading crews to reduce unnecessary roughness in handling the baskets. Most loading crews were made up of inexperienced, seasonal workers with little or no appreciation of the inherent fragility of peaches. Numerous instances of dropping, throwing, and shoving the baskets into place in both types of loads were observed by project personnel. In no instance was the flow of baskets on the conveyors into the trucks at such rapid rates as to require any rough and rapid handling of the baskets by the loading crews. In contrast, it was observed that the older and more experienced loaders handled and loaded the baskets much more carefully and were easily able to keep up with the flow of baskets into the trucks by working a steady pace instead of working in fast spurts and then having to wait until more baskets arrived on the conveyor. Closer and more careful instructions and supervision of loading crews by the shipper, trucker, or experienced loaders can reduce roughness in loading baskets and thereby reduce the amount of fruit bruising in both types of loads.

Fruit Temperatures in Relation to Loading Methods

Pulp temperatures of the fruit were taken at time of loading and again upon arrival at destination. Considerable variations in fruit temperatures were found in both types of loads at time of loading and unloading. Because of the variation in loading temperatures of the fruit and lack of sufficient information on the amounts of refrigeration furnished to the load, these data do not provide a good basis for determining the comparative cooling rates for peaches in the same sizes of baskets loaded by the two methods. The temperature data did show, however, that in many instances temperatures of the fruit in both types of loads were higher at unloading than at loading. In all cases, pulp temperatures at origin and destination were well above those recommended for maximum protection of the shelf life of the fruit.

Previous research, in which the cooling rates of rail shipments of non-precooled Colorado peaches in bushel baskets loaded by alternately inverted and conventional upright patterns were studied, revealed little difference in the comparative cooling rates between the two types of loads. There is no reason to believe that, if the fruit is adequately precooled before shipment and adequate refrigeration is furnished during transit, the fruit temperatures in the alternately inverted loads will differ much from those in the upright loads in truck shipments.

CONCLUSIONS

The alternately inverted loading method can be effectively used for truck shipments of peaches in 1/2-, 3/4-, and 1-bushel baskets to increase load density and thereby reduce transportation and refrigeration cost per container. Loading alternate baskets on their covers in the alternately inverted load does not result in any significant increase in the amount of fruit bruising in transit, compared with the conventional upright load.

The greatest increase in the amount of fruit in the load can be achieved when the alternately inverted load is used for 1-bushel baskets. If the fruit is adequately hydrocooled before loading and adequate refrigeration is furnished during transit, fruit temperatures in the alternately inverted loads during transit should be about the same as those in the conventional upright load.

Peach shippers and truckers can use the alternately inverted loading method with no increase in labor or material costs as compared with the conventional upright method. The amount of fruit bruising and basket damage in both upright and alternately inverted loads can be reduced by closer and more careful training and supervision of loading crews to eliminate unnecessary rough handling of the baskets.

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