

To: Florida Citrus Research Council
From: S. L. Hedden, Agricultural Engineer USDA-AERD
Subject: Study of Handpicking Methods of Fruit Separation
Date: July 18, 1967

This experiment was set up at the request of the Research Council of the Florida Citrus Commission and the results obtained are intended to answer questions presented in Dr. J. T. Griffiths' memo of March 14, 1967, to the Research Council. The Minute Maid Corporation, through Mr. Dwight Lucas, provided the necessary groves, picking crew, and supervision to make the study possible. The work sampling, time study, and storage quality information was obtained by personnel from the USDA, Agr. Eng. Res. Div.; Citrus Experiment Station, University of Florida; and Economics Res. Dept., FCC.

The experiment was primarily concerned with a comparison of handpicking methods and how the methods might be used to partially mechanize citrus harvesting through the use of a mechanical fruit pick-up machine. Much of the citrus picking labor this season has departed from the conventional picking sack by simply removing the fruit and dropping it to the ground to be picked up later by themselves or by a partner.

PROCEDURE

Four variations of handpicking were used. These were:

1. Pick sack (conventional method).
2. Pick and drop fruit on ground under tree, then pick up with pick sack (alternate use of windrower and pick-up machine).
3. Pick and drop fruit on drop sheet under the tree; pickers roll fruit into windrows by pulling drop sheets over from center of tree outward; picker picks up fruit with pick sack.

4. Picker removes fruit and drops it on drop sheet; then rolls fruit into windrow and proceeds to next tree. Fruit windrow is left for machine pick up.

These four picking systems were used one day each week for 4 weeks and the last three methods were used for 2 weeks more with various types of ground clothes. The picking methods were used in a different sequence each week starting on Tuesday.

The drop sheets used to catch the fruit on the ground were varied during the study. Most of the time, however, a pair of 6-mil polyethylene sheets 12 x 25 feet with metal stakes tied on all corners were used by each picker.

Work sampling and time study procedures were used to determine productive picking time for each method and what time was nonproductive in moving the ladder, spreading drop sheets, etc. A ten-man crew was used, made up of men that the crew supervisor considered stable and likely to stay with the study until its conclusion. One man was replaced the fourth week and one man left the sixth week which was considered a good record. The picking was done in three grove locations near Lake Alfred. The study was started April 25 and ran through June 7.

The piece rate pay changed several times during the 6-week period of this experiment. The pickers received 25 cents per box the first week and were given a 5 cent per box bonus starting the second week when they complained about using the drop sheets. The industry-wide rate went up to 30 cents per box the third week and the pickers still received the 5 cent per box bonus through the fifth week whenever they were using the drop sheet methods. During the sixth week, Method 4 was used and a separate pick up crew was used and paid 10 cents per box to pick the fruit up which had been windrowed. The 5 cent bonus was not given to the pickers when the separate pick up crew was

used.

RESULTS

Results of the work sampling are shown in Figure 1 in percentage of total picking time for each picking method. Windrowing the fruit with the drop sheet and leaving it for later pick up allowed the greatest amount of time picking (approximately 70%). Picking by Method 3 was substantially slower than Method 1. The fruit was easier to pick up from a windrow than when it was scattered under the tree, but the time required to handle the drop sheets more than offset these gains.

Tuesday was generally the day of highest output regardless of the method of picking.

The pickers using Method 4 increased their time in picking position by 12.5% over Method 1 (Figure 2) and picked 9.3% more fruit. This data is from the first 4 weeks of the experiment in which all picking methods were used.

Average output per man by each picking method is shown in Figure 3. Output during the fifth and sixth weeks decreased substantially; due possibly to the high daily temperatures and some union activity.

Drop sheets made a material heavier than 6-oz/yd² were difficult for one man to handle. A U-shaped cutout to accommodate the tree trunk was necessary and a piece of tubing in this cutout was needed to keep the edge rigid at the start of the rollout operation to prevent fruit from falling over the edge and remaining under the tree. Corner stakes were helpful for holding the sheets in place. Setting the ladder was not materially affected when the ladder points were cut off half way up the bevel.

DISCUSSION

Almost all factors were controlled in this experiment except the picker himself. The variations caused by the pickers' attitude from day-to-day seemed to offset any gains that could be made by improving the picking method. With no pick sack or containers to handle, the picker was in better physical condition and given an opportunity to pick more fruit with less effort but he did not always do so.

Early and mid-season oranges and grapefruit would probably improve the results because some fruit could be shaken off.

Several types of drop sheets were used to evaluate the idea of separating dropped fruit from culled ground fruit and rolling the fruit out into a windrow. The first material was 6-mil polyethylene sheeting common to the building trades for vapor barriers and weather covers. The roll sheeting was available locally in 12-foot wide rolls at 0.9 cents per square foot. Two sheets 12 x 25 feet were given to each picker. Pegs made from 1/4-inch diameter rod were attached to the four corners to hold the material down when the wind was blowing and to hold the corners in place when one man was working by himself. No cutout was made for the tree trunk. The material was lightweight (7-1/4 lb/sheet), inexpensive, and readily available but was not tough enough to withstand ladder sets, root snags, etc.

One set of 12-oz/yd² treated canvas was tested but this material weighed 46 lb/side and was much too heavy for one man to handle.

One set of 12-oz/yd² vinyl laminated nylon was tested which was lighter than the canvas and easier to slide on the ground but still too heavy for one man to handle (38 lb/sheet). A set of 6-oz/yd² vinyl laminated nylon sheets were made up like the previous set and these proved to be more satisfactory.

Finally, 10 sets of sheets 13 x 26 feet of the 6-oz/yd² material were made up to outfit the entire ten-man crew. The sheets had a cutout for the tree trunk with a 1/2-inch tubular steel piece to hold the U-shape and a metal stake at each corner. A 1/2-inch rope was sewn in the entire hem to provide hand grips for the picker. These latter drop sheets cost \$82.95 apiece or 24.5 cents/ft² and weighed 21 lb/sheet. This would be \$165.90 per picker if each man worked on a separate tree. Where two pickers worked at the same rate in adjoining rows, they were able to pair up on the drop sheet to help roll the fruit out from under the tree. The points on the ladder rails were sawed off so the ladder could be placed directly on the sheeting.

No attempt was made in this study to pair the pickers off so that two people worked each tree. Other members of the crew, not included in the study, were allowed to use the drop sheets and several family groups used them where two or three people worked on the same tree. This was done at their request and under the circumstances, the drop sheet windrow method worked quite well.

One of the advantages to using drop sheets is to get the fruit out from under low skirted trees. This precludes raising the center of the drop sheet to drain the fruit to the outside as it is picked. It would also be difficult to raise the sheet at any point where a ladder would be set.

Fruit decay determined from storage of samples (Figure 4) was low throughout the experiment. This was primarily due to the dry, hot weather which prevailed suppressing blue mold development. Fruit was left on the ground in windrows up to 4 days with fair results though the fruit was sun-scalded. Juice analysis data on the various fruit loads taken by Minute Maie Corporation, Auburndale, are not available at this date.

Perfection of a mechanical fruit pick-up device was not completed this season. One meeting was held March 27 with the Continental-Moss Gordin representatives to discuss a power unit for carrying their pick-up machine and some field trials were run with the CMG machine, June 6-9.

The USDA Tung-nut pick-up machine was tested in the Minute Maid "Summit" grove May 17 and near Winter Garden, May 2, before shipping the unit back to Louisiana. Mr. Gotcher, President of Gotcher Engineering and Mfg. Co., Clarksdale, Mississippi, is presently manufacturing the Tung-nut pick-up and made two visits to Florida to observe and evaluate the spiral brush-type pick up for citrus.

Respectfully submitted,

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