OREGON AGRICULTURAL COLLEGE

EXPERIMENT STATION

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A PRELIMINARY REPORT ON THE HYDROCHLORIC ACID DIPPING PROCESS AND ITS EFFECT ON THE KEEPING QUALITY OF FRUITS

by

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Developments during the past month pertaining to the spray residue situation have proved more serious than anticipated. Reports indicate that it may be impossible to remove, either by hand wiping or mechanical means, the spray residue below the tolerance permitted by health authorities, especially in cases where certain spray programs have been followed. The necessity, therefore, of resorting to some chemical dipping process, at least in extreme cases, is obvious.

Owing to the numerous inquiries that have been received regarding the acid dipping process and its effect on the keeping qualities of the fruit, it is thought opportune to report briefly the observations made by the Oregon Agricultural Experiment Station.

Last April, preliminary chemical tests were carried on by the Experiment Station to learn what chemicals would remove satisfactorily the spray residue from fruit. Limited experiments with various acids, bases, and salts were made. Among those tried, nitric and hydrochloric acid and sodium hydroxide removed the residue from laboratory sprayed fruit very effectively, especially at certain dilutions. At that time it was thought impracticable to continue the work with storage fruit, such as was then available.

As the season progressed, however, it was found impossible to wipe heavily sprayed fruit sufficiently clean. Every mechanical method that seemed feasible was attempted without success. Too much of the residue still remained in the stem and calyx ends of the fruit. It was apparent that a chemical process only would satisfactorily remove the residue. Our preliminary tests indicated that among the chemicals used, hydrochloric acid effectively removed the residue and probably would prove least injurious to the fruit. Consequently, our later efforts were centered upon perfecting the procedure whereby the spray residue was removed by treatment with hydrochloric acid.

On August 17, the Experiment Station began at Medford, Oregon, a series of tests to determine the effects of the various dipping treatments on the dessert and storage quality of apples and pears. At the present time 74 lots of fruit are under observation in common, cold, and car storage. Adequate checks are being kept so that reliable comparisons can be made. The tests are being made with Bartlett, Anjou, Comice, Bosc, and Winter Nelis pears and with Yellow Newtown, Winesap, Jonathan, and Winter Banana apples.

While final conclusions cannot be drawn at this time, certain observations are already apparent from the tests whereby the spray residue was removed by the hydrochloric acid treatment. The lots of Bartlett, Anjou, Comice, and Bosc pears treated for ten minutes with one-fourth and one-half per cent solutions of hydrochloric acid and held in common storage have already ripened and show no ill effects from the treatment, there being no indication that either the dessert or storage quality has been impaired. One lot of Anjou treated with 1.0 per cent hydrochloric acid for ten minutes at a temperature of 84° F., showed slight burning around the lenticels after reaching prime condition. In this case, however, the commercial value of the fruit was not materially impaired. The pears being held in cold storage and at car temperature are all firm and green at this time and show no ill effects from the treatment. Jonathan apples dipped for ten minutes in 1/2 per cent hydrochloric acid solution and kept in common storage are now in good condition for eating and appear to be normal in all respects. The other varieties of apples are all holding up nicely in both common and cold storage. In all cases the fruit treated with the hydrochloric acid has been unusually clean and attractive in appearance upon reaching maturity.

For the benefit of those who may desire to use the hydrochloric acid dip process to remove the spray residue, the following general information may be of assistance:

No effort has been made by the Experiment Station to perfect any mechanical apparatus through which the fruit may be passed, washed, and dried.

The hydrochloric acid dipping bath may be prepared by adding one (1) gallon of commercial hydrochloric or commonly called muriatic acid, 20° Baume' gravity, to 100 gallons of water. The length of time necessary to dissolve the residue depends upon t the temperature of the bath and the amount of spray on the fruit. About 75° Fahrenheit is optimum temperature for the bath. The fruit should not be allowed to remain in the acid bath any longer than necessary. Ten minutes should suffice for even heavily sprayed fruit. Each gallon of the commercial muriatic acid when diluted should dip at least 400 boxes of fruit.

After dissolving the spray residue in the acid bath the fruit should be dipped immediately in another tank containing a neutralizing bath of sodium bicarbonate or baking soda. This

is prepared by adding 1 pound of soda to each 100 gallons of water used in the tank. Subsequently 1 pound should be added to a 300-gallon tank after dipping 400 to 500 boxes.

After neutralization, the fruit should be washed by sousing in clean water and then dried.

For dipping on a small scale the apparatus and procedure described below has been found satisfactory.

Directions for Preparation of Dipping Baths

Make three wooden tanks: Tank #1, 12 feet long x 3 feet wide x 1½ feet deep; tank #2 and #3, 6 feet long x 3 feet wide x 1½ feet deep. Make out of 2" lumber, using screws (not nails) with asphaltum to seal mortised joints. Tanks to be filled 4 inches from top.

Wooden frame carriers to hold fruit are made of wood and about 1 inch mesh tennis netting. Each carrier to hold one box of fruit. If the netting is dipped in boiled linseed oil containing about 10% drier and dried over night it will last much longer.

TANK #1 - Hydrochloric Acid Dipping Bath:

For each 100 gallons of water used, add 1 gallon of commercial hydrochloric acid, 20° Baume.

Each 100 gallons of the dilute dipping acid will dip about 400 boxes of fruit and then bath should be emptied and a fresh supply of the dilute acid prepared. For example, a 500 gallon tank will dip at least 2000 boxes.

To keep dipping bath at constant level, add the amounts of dilute acid necessary, prepared as follows:

Add 1 quart of acid to 25 gallons of water.

TANK #2 - Sodium bicarbonate or Baking Soda Neutralizing Bath:

Add 1 pound of soda to each 100 gallons of water. Keep soda dipping bath strongly alkaline by adding ½ pound after dipping each 200 boxes. Add water as needed to keep enough in tank. Change after dipping 600 boxes.

Procedure

Fill Tank #1 with necessary amount of acid and #2 with soda solution. A third tank (#3) to be used for final washing, is filled with clean water. The clean water should be continually running in one end of the tank and out the bottom of other end.

Place fruit in carriers, using as many as can be conveniently dipped and removed in about ten minutes.

Ten or twelve minutes is about a maximum time fruit should be in acid bath. If small amounts of spray residue appear to be present on fruit, reduce length of time in bath as much as possible.

As the carriers are supported in tank #1 they are agitated by sousing up and down as they are moved along from one end of the tank to the other end from which they are lifted and held a moment to let excess acid drip off. The carrier is then dipped in tank #2, and raised and lowered as much as time will allow. Again hold a moment to let excess soda drip off. Finally, dip in tank #3 in same manner, raising and lowering to wash with the clean water thoroughly. Empty in boxes and dry.

CAUTION. No metal of any kind should come in contact with the acid bath.

When carriers are not in use, dip in soda bath before laying aside for future use.

IMPORTANT PRECAUTION: It is very important that the temperature of the acid dipping bath be kept at about 75° Fahrenheit during process and that the fruit be agitated by sousing as much as possible. Otherwise the spray residue will not be dissolved.