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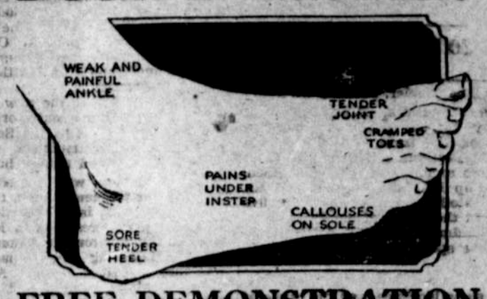

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TESTS SHOW HOW TO REMOVE RESIDUE

(By Henry Hartman, Associate Horticulturist, and R. H. Robinson, State Chemist, Oregon Agricultural College, in Better Fruit. These authors have been working in cooperation with other members of the Station Staff including: Leroy Childs, S. M. Zeller, R. K. Norris, D. E. Bullis and R. A. Osborn, and also with individual growers and growers' organizations in various parts of the state.)

Owing to the numerous inquiries that are being received regarding the removal of spray residue, it is thought opportune to report briefly the observations made by the Oregon Experiment Station. It must be borne in mind, however, that some of the experiments are still uncompleted and that a final report cannot be given at this time. The present paper is merely an attempt to summarize briefly the results that have been obtained thus far. In the near future, the complete data from these tests will be published in the form of a station bulletin.

Although many phases of the spray residue problem have been considered, most of the work on this project has been along two major lines as follows:

(1) A study of various means for the removal of spray residue.

2) A study of the effect of these means upon the dessert and storage quality of the fruit.

Attention was first given to such mechanical or physical means of removing residue as hand wiping, machine wiping and brushing. Results in this case were obtained from both laboratory tests and from field observations in the various apple and pear districts of the state.

Experiments with solvents or "washes" for the removal of spray residue were started by the Oregon experiment station in April of last year and have continued to the present time. Over 500 chemical analyses have already been made in connection with this phase of the work. The list of chemicals tried includes all acids, bases and salts that seemed to offer possibilities. The following list of compounds which were tested gives a fairly good idea of the materials tested:

Inorganic Acids—Hydrochloric, nitric, sulfuric, sulfurous, phosphoric, boric.

Bases—Sodium hydroxide, potassium hydroxide, sodium carbonate, sodium bicarbonate, calcium hydroxide, ammonium hydroxide, soda lime.

Salts—Sodium chloride, potassium sodium thiosulfate, ammonium chloride, sodium borate, copper sulfate, calcium sulfate, sodium chromate, sodium acetate, sodium nitrate, calcium acid phosphate, calcium chloride.

Organic Acids—Malic, citric, tartaric, acetic, oxalic, tannic, carbonic.

Miscellaneous—Cane sugar, glucose, alcohol, sodium stearate, sodium oleate, miscible oils, potassium benzo sulfate.

Most of the above compounds were tried at different strengths, different temperatures and for different periods of time. Many of them were tried in combination with other compounds. Hydrochloric acid gave best results.

August 17, experiments were undertaken in the Rogue river valley to determine the effects of the various cleansing treatments on the dessert and storage quality and also on the appearance of the fruit. These experiments were later enlarged so as to include apples and pears from the Hood River and Willamette valleys. Up to the present time, over 700 separate lots of fruit have been under observation in cold, common, and car storage. Adequate checks of untreated fruit were kept in each case so that reliable comparisons could be made. Twenty-two of the leading commercial varieties of apples and 17 varieties of pears have been included in these tests. Aside from the above experimental lots, the station has had opportunity to observe the effects of both mechanical and chemical methods on a goodly portion of the fruit commercially treated during the past season.

The removal of spray residue by mechanical means has generally proved to be unsatisfactory. No form of mechanical cleansing thus far tested out has effectively removed the residue in all cases. Where heavy or even moderate spray programs have been followed, a considerable amount of residue usually remains in the calyx and stem cavities no matter how much care has been exercised in wiping or brushing. The roughened or russeted areas of apples and pears have also been found to contain residue following mechanical treatment.

Aside from this, wiping or brushing may result in injury to the fruit itself. Hand-wiped specimens of Grimes, Yellow Newtowns, Jonathans, Spitzenburg, Waggener and Rome apples have consistently lost weight much more rapidly in common storage than have the unwiped checks of the same varieties. In all cases, the wiped apples have shown more visible wilt and have displayed signs of breakdown somewhat in advance of the untreated fruit. Wiped Yellow Newtown apples turned yellow several days sooner than did the unwiped fruit from the same tree. Mechanical cleansing devices may also aid in the spread of decay organisms. This is especially true in cases where late picked or ripe fruit is being treated. Brushes and wipers frequently become contaminated and in turn, may convey the spores of such storage rots as blue mould, gray mould, anthracnose and perennial canker to stem punctures or other abrasions on the fruit.

The Use of "Washes" or Solvents—Experiments on this phase of the project have revealed the fact that acids and bases, in general, will remove spray residue in varying degrees of effectiveness. These tests, however, have shown very clearly that under no consideration can any compound be considered as satisfactory until an adequate storage test has shown that no injury to the fruit results from its use. This has been especially true in cases where bases such as sodium hydroxide have been used. Fruit which showed no ill effects immediately after treatment has often developed serious injury at some stage of the storage period. This point cannot be overemphasized.

Hydrochloric Acid Satisfactory—Of the many compounds tested, none have proved to be superior to hydrochloric acid. When used at concentrations varying between one-fourth and two per cent (actual acid) this compound has been found to be very effective in the removal of spray residue, and at the same time, has proved to be non-injurious to the fruit when properly used. Aside from this, hydrochloric acid has several advantages that should be mentioned. First, it is a comparatively cheap chemical and can be obtained in large quantities. Second, it is effective at low temperatures, a factor of no mean importance in deciduous fruit regions. Third, it is a non-oxidizing compound, and, therefore, it is not apt to cause discoloration, especially in injured tissue. Fourth, it is a volatile substance and consequently disappears of its own accord in cases where rinsing has not been thoroughly done. Fifth, it is easily washed from the fruit after treatment. Sixth, it is not a disagreeable material with which to work. Seventh, it removes from the fruit not only the arsenicals, but is also efficient in the removal of lead, copper and other forms of residue. Eighth, it does practically no damage to the wax or protective covering, and leaves the fruit in a clean, attractive condition.

Neutralising Bath may be Eliminated—In the early recommendations concerning the use of hydrochloric acid (Ore. Cir. of Information No. 11), a neutralizing bath consisting of one pound of soda (sodium bi-carbonate) to 100 gallons of water was recommended. Subsequent experiments tend to show, however, that the neutralizing bath is necessary only in case efficient rinsing cannot be done. Where plenty of clean water is available, the neutralizing bath should not be necessary.

Other Acids Less Desirable—Other acids such as nitric, acetic, and sulfuric, while promising in some respects, have proved to be generally inferior to hydrochloric acid. Nitric acid is quite efficient in the removal of residue, and when properly used, does not injure the fruit. This compound, however, is considerably higher in price and is less desirable for the reasons that it is an oxidizing substance, and that it is much less volatile than hydrochloric acid. Acetic acid has proved to be inefficient except when used at high concentration. Sulfuric acid seems to remove the residue but in some cases may do damage to the fruit.

Bases or "Alkalies"—Although bases in general tend to remove spray residue, sodium hydroxide (caustic soda) is the only basic compound discovered in these studies which successfully removes arsenate of lead under all conditions. This compound, however, has proved to be inferior to hydrochloric acid in several ways.

Efficiency of Solvents Affected by Many Factors—The efficiency or the rate at which solvents remove spray residue may be affected by several factors.

Agitation—Of all the factors that affect efficiency, probably no factor is of more importance than agitation of the solution while the fruit is being treated. Repeated tests have shown that in cases where no agitation was employed, from 10 to 20 minutes were often required to remove even the visible residue. But when the solution was sprayed on to the fruit or applied with force, the visible residue was often removed in from 10 to 20 seconds.

Spray Program Followed — The amount of treatment required to successfully clean fruit is also dependent in a large measure, upon the spray program that has been followed. In cases where heavy deposits of residue are on the fruit, it naturally follows that more solvent action will be required to do the work. The use of oil or spreaders in connection with lead arsenate also tends to retard the removal of the residue.

Maturity of the Fruit—The efficiency of the solvents is also associated with the degree of maturity attained by the fruit at the time of treatment. Apples at picking time respond much more readily to treatment than they do later on when wax development has taken place. This is especially true of such varieties as Arkansas Black, Spitzenburg and Winesap.

Injury from the Use of Solvents—It must be borne in mind that a solvent sufficiently strong to dissolve spray residue is apt to cause injury to the fruit if used at excessive concentrations, at too high temperatures or for too long a time. In the case of hydrochloric acid, however, the margin of safety between the point of efficiency and the point of injury is sufficient to insure good results when the necessary precautions are taken. Improper rinsing after treatment may also result in injury to the fruit. Definite recommendations concerning temperatures, concentration, length of treatment, and rinsing will be made in the bulletin mentioned earlier in this paper.

Pathological Studies—Studies on the pathological phase of this problem have shown that such solvents as hydrochloric acid, nitric acid, and sodium hydroxide have but little fungicidal value when used at the strengths recommended. In the case of such organisms as blue and gray mould, hydrochloric acid had little or no effect upon the spores unless it was used at concentrations of at least 4 or 5 per cent. The possibility of using a fungicide along with the solvents, however, is being investigated and the results obtained thus far are promising in some respects. More work must be done, however, before definite recommendations can be made concerning this part of the work.

Editor Potts of Better Fruit says:

"The accompanying article was prepared to give fruit growers and packers a general idea of work being done at the Oregon Experiment Station to solve the spray residue problem. Since the problem first became acute during last season, a great deal of effort was put forth to find some possible and economical way of relieving the situation.

Many inquiries have been received regarding these experiments and as the work has not been entirely completed it has been impossible to supply all of the desired information.

"A complete report will be published later in the form of a regular station bulletin.

"There will be no material change in spray recommendations of state and government experts this year. I have excellent authority for making this statement.

"Many apple and pear growers have hoped that a change of spray program might be evolved to solve the residue problem. At this time there is little evidence that the problem will be solved in this manner in 1927.

"The alternative obviously must be to center efforts upon effective and inexpensive means of cleansing away the residue. It is a matter of pride that we are the first to present the results of scientific research into the subject of residue removal."

Soluble minerals are utilized by home economics girls at the Oregon Agricultural College. They use the water from boiled vegetables in gravy, soup, mashed potatoes, and bread-making.

Notice to Creditors

Notice is hereby given: That the undersigned has been appointed Administrator of the Estate of Frank E. Matt, deceased, by the County Court of Hood River County, Oregon, and has duly qualified as such. All persons having claims against said Estate are hereby notified to present the same, verified according to law, to the undersigned, at Room 16, Pythian Building, Hood River, Oregon, within six months from this date.

Dated and first published January 27, 1927.

GEORGE R. WILBUR,
Administrator.

j27f17

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