

PROGRESS REPORT

PROJECT NO: 76 - ARS

TITLE: Effect of Postharvest Pear Handling and Storage Conditions on Survival of the Fire Blight Bacterium on Fruit Surfaces

YEAR INITIATED: 1999-2000 **CURRENT YEAR:** 2000-2001

TERMINATING YEAR: 1999-2000

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ACCOMPLISHMENTS:

The fire blight disease, caused by the bacterium *Erwinia amylovora*, is a major barrier in efforts to export pear fruit to countries where this disease has not been reported to occur. Potential foreign markets include China, Australia, and South American countries.

In previous studies supported by the Washington Tree Fruit Research Commission, detection of the bacterium in association with healthy mature pear fruit was extremely rare, even when fruit were harvested from orchards with a relatively high incidence of fire blight. A series of tests also demonstrated that the risk of transmitting fire blight on fruit is further diminished by postharvest treatments with sodium orthophenylphenate (SOPP), a microbiocide already used within the pear industry. Data indicating the rare incidence of *E. amylovora* on fruit, coupled with the high-efficacy results with SOPP, were instrumental in maintaining the Brazil pear market when that country imposed new quarantine regulations.

Further investigations during the past funding year (1999-00) were done at the request of the Northwest Horticultural Council to better assess the risk of spreading fire blight via fruit based on the total postharvest pear handling and storage system. Preliminary tests indicated that when *E. amylovora* was artificially applied to d'Anjou pear fruit the population size declined rapidly over time under typical cold storage and controlled atmosphere conditions. The inability to detect bacteria after 2 to 4 weeks was considered good news, since winter pears are normally held in cold storage for 6 to 8 weeks prior to shipment to insure ripening. Results of the larger experiment, though not finished at this writing, indicated a similar decline in numbers; however, bacterial cells were still detected 4 weeks

after application to d'Anjou fruit. The population size decreased from approximately one million colony forming units (CFU) per fruit at the start of the experiment to less than 100 CFU 4 weeks later. The downward trend is expected to continue.

Rate of bacterial decline was greatest in a regular atmosphere and temperature of 68°F. When fruit were stored in a regular atmosphere at 32°F for 7 or more days and then held for an additional 14 days at 68°F, bacteria could not be detected on fruit. Thus, any risk of transferring *E. amylovora* is further reduced during or after the time fruit are at market.

The present study along with previous work could have an impact on the export market of pears. The information as a whole indicates that the overall risk of transmitting the fire blight bacterium on pear fruit subjected to current handling and storage practices is extremely low.

RESULTS:

A cell suspension of *Erwinia amylovora* was applied to d'Anjou pears by spraying the entire fruit surface. After the fruit had dried, the starting bacterial population size was determined to be approximately one million CFU.

Fruit were then placed in laboratory chambers to simulate different storage conditions as follows: (1) Regular atmosphere (RA) at 68°F; (2) RA at 32°F; (3) Controlled atmosphere (CA) of 1% CO₂ and 1.5% O₂, 32°F; (4) CA of 1% CO₂ and 2.0% O₂, 32°F; (5) RA at 32°F followed by RA at 68°F; and (6) CA of 1% CO₂ and 1.5% O₂ followed by RA at 68°F. Relative humidity was maintained at 90% in all treatments. For treatments 1, 2, and 3, 10 fruit per trial were sampled after 0, 1, 3, 5, 7, 14, 28, and 56 days. For treatment 4, fruit were sampled after 0, 14 and 28 days. For treatments 5 and 6, fruit were held in RA or CA at 32°F for 7, 14, or 28 days before transferring to RA at 68°F for 14 days to simulate retail conditions.

In all treatments bacterial populations steadily and rapidly declined over time. The following are based on averages of two trials. After 28 days, bacteria were detected in treatments 1, 2, 3, and 4 at levels of 2, 10, 95, and 31 CFU per fruit, respectively. In treatment 5, after 7 or 14 days of CA and 14 days of RA at 68°F, less than 1 CFU per fruit was detected. In treatment 6, after 7 or 14 days of RA at 32°F and 14 days of RA at 68°F, no bacteria were detected.

As a secondary objective, bacteria were recovered separately from the peel and calyx areas of fruit stored in CA for 0, 1, 7, 14, and 28 days. Results indicated a similar rate of bacterial decline for these two parts of d'Anjou fruit.

Another objective yet to be completed is to test the effect of wash solutions commonly applied to fruit in packinghouses on bacterial survival.

PUBLICATIONS:

Tentatively data from this and previous research relating to fire blight as a barrier to the export of pear fruit will be compiled in one scientific publication. Possibly the report will be of use to government quarantine officials or trade negotiators in efforts to open or maintain foreign export markets for pears.