8. TREE FRUIT DISEASES

FIREBLIGHT CONTROL EXPERIENCES IN THE SACRAMENTO VALLEY OF CALIFORNIA 1973-1999.

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A comparative system for predicting fireblight was developed in the early 1970's. The system is based on the measurement of accumulated heat units, which allow multiplication and spread of the causal bacteria prior to infection courts. Blight bacteria levels were measured in blossom samples examined during these periods and compared with the accumulated heat unit levels prior to collection of the samples. The increasing rate of population development with increasing heat accumulation can be visualized (Figure 1).

The infection periods are certain wetting events supplying a moisture film, such as rainfall or the simultaneous occurrence of 57° F temperatures (or greater) with at least 90% relative humidity. These latter events can be read using hygrothermographs. They often occur at night and are likely related to dew periods at temperatures sufficient for the bacteria's multiplication. These films allow the bacteria to move from multiplication sites such as the stigmas of flowers or older infections to infection courts such as the nectaries of flowers and in some cases shoot tips, wounds or fruit tissues if inoculum levels are high, such as occurs when older infections are more prevalent in the orchards.

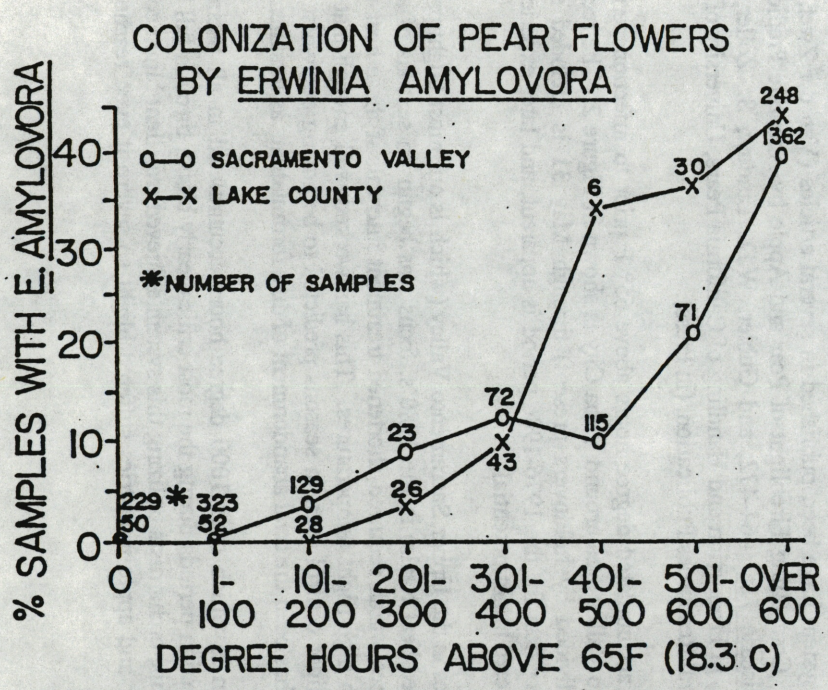
During 1976 to 1986, extensive monitoring of individual infections occurring in Bartlett pear orchards in the upper Sacramento district around Yuba City was performed and counts showed a high correlation ($r = 0.86$, $p = 0.001$) of the ratio of new infections to older, holdover infections counted through May 31 of a given year, with the number of accumulated heat units (degree hours above 65° F) prior to these wetting events described above during the period early bloom through full bloom plus 15 days. These findings and a resulting control system have been published in several articles (Van der Zwet, T., Zoller, B.G., and Thomson, S.V. 1988. Controlling Fireblight of Pear and Apple by Accurate Prediction of the Blossom Blight Phase. Plant Disease 72: 464-472; and Gubler, W.D., Lindow, S., Zoller, B.G., and Duncan, R. 2000. Pear Diseases, In Production and Handling of California Pears, University of California, Division of Agriculture and Natural Resources Publication, (in Press).

The record of seasonal accumulated degree hours above 65° F prior to infection periods during 1973-1999 in the mid Sacramento Valley area around Yuba City is shown in Figure 2. The record of new infections counted per block (divided by holdovers present) through May 31 is included so that the correlation with accumulated prior heat for the 1976-1986 period is apparent, and later experiences 1987-1999 can be compared with predicted blight potential.

As a result of experiences in the Upper Sacramento Valley (which is our most blight prone district because of the higher accumulated heat totals) in the 1980's, focus was begun on seasons of at least 500 degree hour accumulations as ones which required shortened treatment intervals if these heat units occur during major bloom periods with high night temperatures. This has worked well enough that it has now been possible to achieve good blight control even in seasons predicted to be among our worst. The final step allowing success every year has been the total abandonment of dust formulations as treatments.

1997 was such a season in which over 1000 degree hours accumulated in all Sacramento-San Joaquin Valley areas prior to infection periods during the most critical early bloom through full bloom plus 15 days time frame. In spite of this, orchardists utilizing this system achieved excellent blight control while much of the Central Valley pear and apple industries suffered blight so severe it even reached the local newspapers.

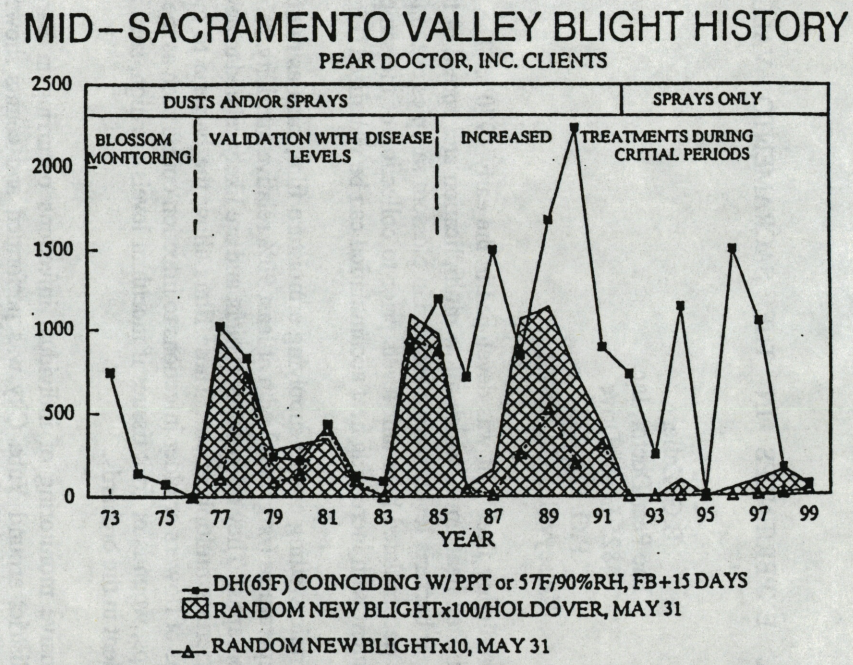
FIGURE 1



PERCENTAGE OF SAMPLES COLONIZED WITH E. AMYLOVORA VS. DEGREE HOURS ABOVE 65F (18.3C) SINCE LAST 3-DAY PERIOD WITH NO TEMPERATURE ABOVE 65F (1972-1976). (VAN DER ZWET, T. ET.AL. 1988. PLANT DISEASE 72: 464-472.)

THE RATE OF COLONIZATION OF PEAR FLOWERS BECOMES GREATER WITH INCREASES IN THE ACCUMULATED DEGREE HOURS PRIOR TO SAMPLING. THE REACHING OF 500 DEGREE HOURS IS USED AS A TRIGGER TO INCREASE TREATMENT FREQUENCY IF IT OCCURS DURING MAJOR BLOOM PERIODS WITH WARM NIGHT CONDITIONS PREDICTED.

FIGURE 2



DURING THE 1976-1986 PERIOD WHEN INFECTIONS WERE COUNTED, THE CORRELATION BETWEEN THE ACCUMULATED DEGREE HOURS PRECEDING INFECTION PERIODS AND THE RATIO OF NEW INFECTIONS TO HOLDOVER INFECTIONS WAS HIGH, r = 0.86 (P = 0.001) (VAN DER ZWET, T. et.al. 1988. PLANT DISEASE 72: 464-472). THIS RATIO YIELDED A MUCH HIGHER CORRELATION THAN SIMPLY RELATING NEW BLIGHT TO THE DEGREE HOURS. RANDOM NEW BLIGHT DOES NOT INCLUDE NEW INFECTIONS ON TREES WITH HOLDOVERS PRESENT OR BLIGHT ON TREES NEXT TO HOLDOVER TREES. INFECTIONS RESULTING FROM THE EPIPHYTIC BACTERIAL POPULATION ARE THUS SEPARATED HERE FROM ONES ARISING AS A RESULT OF SECONDARY SPREAD OF BACTERIA BY RAIN.