# Eradication of Fireblight in Norway 1986 to 1998

**Arild Sletten**
Norwegian Crop Research Institute, Plant Protection Centre, Department of Plant Pathology, Fellesbygget, N-1432 Ås, Norway

**Fireblight is a destructive disease of apple, pear, and some commonly grown ornamentals. Many countries have expended a great deal of resources attempting to eradicate the disease, but few have experienced success. Fireblight eradication in Norway during 1986-1998 is reviewed. Among important factors to avoid fireblight introduction and establishment are early detection of the disease and the establishment of a programme with the necessary statutory powers and resources to do surveys and remove diseased plants. Testing for latent infections in plant propagation could be of importance. Planting of highly susceptible host plants should be banned.**

## INTRODUCTION

Fireblight, caused by the bacterium *Erwinia amylovora*, is regarded as one of the most destructive diseases of pome fruits in the world. It rapidly kills flowers and shoots, and may spread further into branches and the trunk, whereby the tree usually dies. Trees may be killed in one season. The incidence and severity of fireblight is highly dependent on rainfall and temperature conditions. The most commonly affected hosts are pear (*Pyrus*), apple (*Malus*), hawthorn (*Crataegus* spp.), *Cotoneaster* spp. (particularly the larger species), *Sorbus aria*, and *Pyracantha* spp. Fireblight has been known in North America since 1780, it appeared in New Zealand in 1919, and in England in 1957. In 1966 the disease was detected in the Netherlands, and during the next 30 years it became established in most of the other European countries. Up to 1998 fireblight was known in more than 40 countries (EPPO, 1997). In the European Community Finland and Portugal are now the only countries where the disease has not been detected.

## EXPERIENCES WITH THE CONTROL OF FIREBLIGHT

Fireblight may cause serious losses in apple and pear orchards, both in the current years crop, and in the subsequent years production by killing fruit spurs, branches, and whole trees. In the U.S.A., pear cultivation has been largely abandoned in some states because of the disease. In parts of Europe with warm conditions at first flowering (18 to 24C), frequent periods of rain or high humidity, and highly susceptible pear cultivars, severe losses have been reported. Fireblight is usually not of major economic importance to apple and pear production in northern Europe but occasionally damage could be severe. Commercial growers of ornamentals may also experience heavy losses because of the disease (Garrett, 1990). Indirect losses to growers because of export difficulties as a result of quarantine measures are also of considerable importance.

Although fireblight has been known for about 200 years, there is still no completely satisfactory and reliable control measure. The present knowledge of the disease cycle and the many factors that affect disease development demonstrate that there

is no single, easy answer to fireblight control. Successful preventive measures are import restrictions of susceptible hosts from countries where the disease occurs, eradication and containment campaigns to stop or limit spread soon after the introduction of fireblight, and orchard management of susceptible hosts to minimise the effects of infection, including encouragement of the use of cultivars that are resistant or have low susceptibility.

Fireblight is difficult to control with known chemicals. None of them are curative and must, therefore, be used to prevent entry and establishment of the pathogen. Copper compounds and antibiotics have been used with some success, but they both have severe disadvantages. Some new chemicals have been introduced recently, showing promising results in controlling fireblight, but they need further investigation under a range of conditions. Among other approaches are the use of biological control agents, which again need much testing before they can be released commercially. With our present knowledge the best control of fireblight can be attained through an integrated programme of legislation, good orchard management, and the use of preventive sprays.

The EPPO (1990) recommends all countries to list *E. amylovora* as a quarantine pest. According to the specific quarantine requirements put up by EPPO, countries which do not yet have the disease in whole or major areas of the country should prohibit the import of plants for planting and cut branches from host plants from countries where *E. amylovora* occurs. Most countries follow these recommendations, and planting of the most susceptible hosts are banned. In spite of this, fireblight continues to spread. Dissimination of *E. amylovora* by air, insects, and birds is important, but introduction of the disease into some countries, like Norway, most likely has been by infected nursery stock. In most countries, following the initial discovery of the disease, eradication campaigns have been initiated. These intensive and costly measures have served to delay the eventual spread of fireblight and have thus enabled other measures to be prepared and brought into operation. If an eradication campaign fails, it is usually succeded by containment policies to protect the interests of fruit growers and nurserymen, to restrict spread of the disease, and to preserve the landscape.

Few, if any country have yet managed to completely eradicate fireblight. Several countries have had success in containing the disease, at least for some years. Others have given up at an early stage, usually because of lack of money for eradication campaigns, and very rapid spread of the disease.

## CONTROL OF FIREBLIGHT IN NORWAY

In Norway fireblight was detected for the first time in 1986 (Sletten, 1990). The focus of infection was in the county of Rogaland, in and around the city of Stavanger on the south west coast of the country. Diseased plants were found in private gardens, around public buildings, on recreation grounds, along roads, and in rural areas. In this district there is no commercial fruit-growing, however, many large nurseries are situated there. Spring is often dry and cold, but in the summer temperatures can be well above 20C. Rainfall in July, August, and September is usually high. *Cotoneaster bullatus* and *C. salicifolius* were the two most important hosts, but the disease also occurred on other *Cotoneaster* spp., as well as on *Sorbus aria* and *Pyracantha coccinea.*

A Government funded eradication campaign was set up in 1986. The Norwegian Crop Research Institute, the Plant Quarantine Inspection Service, and the local County Agricultural Advisory Service were in charge of the eradication campaign. The aim was to protect large nurseries in Rogaland, as well as important fruit-growing areas about 40 km north of the infection site. Weather data from these areas analyzed with Billing's revised system for fireblight risk assessment (Billing, 1992) indicated that weather could be favorable for fireblight development. The campaign has been carried out every year, with a total expenditure of about NOK 5 million. So far no compensation for the removal of diseased plants has been paid.

The necessary statutory powers for the campaign were given in the Fireblight Disease Order. The disease is notifiable, and the cultivation, production, and sale of *C. bullatus* and *C. salicifolius* are prohibited throughout the country. A quarantine area of about 700 $km^2$ was established around the focus of infection. Within this area the production and sale of all common fireblight hosts were prohibited, and such plants were not allowed to be removed from the area. From the quarantine area *C. bullatus* and *C. salicifolius* were allowed to be removed from private and public grounds, regardless of whether they were attacked by fireblight or not. Around fruit orchards and nurseries protective zones of 500 m, free from the most susceptible hosts were established. Beehives in the quarantine area were only allowed to be moved to areas free from fireblight hosts.

In the growing season of the first years of the campaign, between 20 to 40 persons were engaged in the tracing, cutting, and removal of diseased plants. Roots were killed with glyphosate or imazapyr. In 1989 the strategy was changed. To reduce the possible build-up of inoculum on *C. bullatus* and *C. salicifolius,* these two species were completely removed from about 300 $km^2$ of the quarantine area. The work started from the south, where fireblight so far had not been detected, and moved north, into parts where the disease was common. More than 60,000 private gardens were checked, in addition to public areas, recreation grounds, and rural districts. The efficiency of removing and destruction of plants was greatly increased when we instead of burning plants used a transportable wood chipper, grinding shoots, branches, and stems quickly into fine chips, which were decomposed in heaps for a year. By voluntary agreement all nurseries in the quarantine area stopped their production of the most common hosts of fireblight, and they destroyed their stocks of *C. bullatus* and *C. salicifolius.*

These drastic measures could not have been accomplished if the public awareness of the disease and its destructive potential had not been raised at an early stage of the campaign. Information about fireblight and which measures that were to be taken were given in leaflets distributed to the public by post, and in "grower bulletins". Newspapers and local radio stations gave regular reports about the progress of the campaign.

Fireblight was detected at around 2000 locations in the quarantine area during the years 1986 to 1993. Disease incidence increased during the first years, but from 1990 there was a decrease in number of new outbreaks. Fireblight also became limited to the two main hosts. Since 1993 fireblight has not been detected, either in the quarantine area nor in other parts of the country. The systematic surveillance of the quarantine area has continued every year, and in 1998 it was extended to many other counties in Norway, particularly in the

eastern part of the country. Trained personel have been looking for the disease in nurseries, garden centres, fruit orchards, private gardens, and recreation grounds in build-up areas. So far, fireblight has not been detected.

## CONCLUSIONS

It has been of advantage that there was no commercial fruit-growing in the district with the first outbreak of fireblight, and that the disease did not enter nurseries. The removal of the main hosts greatly reduced the build-up of inoculum, and made the surveillance work easier. Among other important factors for the success can be mentioned the establishment of a well organized eradication campaign shortly after fireblight was detected for the first time. Many countries have experienced that the failure of eradication is not caused by insufficient legislation and organization of the campaign, but by the common distribution of very susceptible host plants, in particular if some of these are wild growing. Infections in ornamentals in build-up areas and cities are usually extremely difficult to control, and they may be an important reservoir of inoculum for further spread of the disease. A low level of infection is not easy to detect, even with extensive surveys and trained personel. It may go on unnoticed for a long time, especially if weather conditions are unfavorable for rapid disease development.

## LITERATURE CITED

**Billing, E.** 1992. Billing's revised system (BRS) for fireblight risk assessment. EPPO Bulletin 22:1-102.

**EPPO**, 1990. Specific quarantine requirements. EPPO Technical Document No.1008:59-60.

**EPPO,** 1997. EPPO Distribution List of *Erwinia amylovora*. EPPO Reporting Service 97/079.

**Garrett, C.M.E.** 1990. Control of fireblight. CEC Agrimed research programme. Fire blight report (1990), EUR 12601.

**Sletten, A.** 1990. Fireblight in Norway. Acta Hort. 273:37-40.