

# Causes of the Premature Death of Cherry Trees

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In recent years many farmers have been complaining about premature death of cherry trees, both in old and in young orchards. The dieback is usually preceded by reduction in leaf size and change in leaf colour; in some trees the leaves turn yellow and fall earlier than usual, while in others premature reddening appears, the leaf blade curls inward, wilts and dries out. Sometimes the leaves fall, and in other cases they remain until the following spring. Individual branches and scaffold limbs dry out, and gummosis is sometimes observed.

Cankers appear on the trunks, scaffold limbs and branches, often around wounds caused by low temperatures, mechanical injuries from machinery and heavy pruning. Usually the cankers are covered with gum, but there are also such without gum. When the bark is peeled at the site of damage, it can be seen that the cambium and the wood are dark brown. Damage is also observed on terminal shoots and buds, which do not develop in spring,

remain dry and are covered with gum. When some trees are uprooted, tumours of various sizes are found. Very rarely, and only in sites where water is retained for a longer period, cankerous damage is observed in the root collar zone, where the tissues are watery and coloured orange-red. In some trees the dieback progresses over a number of years, while in others it is sudden.

Premature decline of stone fruit species was established as early as 1890, but up to now there is still no unified opinion on the causes that induce this phenomenon. According to some researchers, the death of trees is due to pathogens (fungi, bacteria and viruses), while according to others the cause is non-infectious. There are also reports that premature decline has a complex character. The results of studies carried out years ago at the Institute of Agriculture in Kyustendil, as well as observations in recent years, give us grounds to assume that the causes of this phenomenon are usually different for individual orchards.

The decline may be caused by: unsuitable sites and rootstocks, asphyxia, incompatibility between rootstock and scion, drought during the first years after planting, bacterial canker (blight) caused by *Pseudomonas syringae*, and in recent years there has been a report by Nakova (2011) of decline due to *Phytophthora* root and crown rot caused mainly by *Phytophthora cactorum*. Very often premature decline is due to a combination of several factors.

### **Unsuitable sites and rootstocks**

Cherry trees are grown at the same site for about 30 years, which necessitates compliance with all technological requirements for orchard establishment. Every mistake made is irreparable and subsequently leads to inefficient fruit production and sometimes to premature death of trees. Of particular importance is the correct choice of site for a new orchard, where climatic, terrain, soil and other conditions are assessed. All of them must meet the biological requirements of the cherry, including the rootstock on which the cultivars are grafted.

Closed basin fields, closed valleys and sites unprotected from cold and warm air currents are not recommended.

For all rootstocks, heavy, clayey, waterlogged, impermeable, cold and acidic soils, as well as those with shallow groundwater and a shallow soil layer, are unsuitable.

A characteristic feature of cherry rootstocks is that they have specific requirements regarding soil conditions. For example, mahaleb cherry adapts best on sloping terrains and sites with light, well-aerated, sandy-clay and alkaline soils. Wild cherry requires deep, moderately moist, warmer, clay-sandy and slightly acidic soils. The

new weak and moderately vigorous rootstocks Gisela 5, Gisela 6, MaxMa 14, etc. are recommended for fertile, deep, moisture-retentive and slightly acidic or neutral soils with assured irrigation.

At this stage, fruit tree nurseries in our country produce cherry planting material mainly on mahaleb rootstock. In many places, however, the soils are slightly acidic and of heavier mechanical composition, i.e. suitable for wild cherry rootstock. In these cases, fruit growers face difficulties in securing planting material and plant trees grafted on mahaleb. Liming is recommended to correct soil pH, but it has no lasting effect and must be applied every 3–4 years.

More critical for the development of trees on mahaleb are heavy, compacted and waterlogged soils with shallow groundwater. In such sites the trees start to die from *asphyxia* (root suffocation) at an early age and massively after the eighth–twelfth year.

In existing cherry orchards we have observed waterlogging of the soil as a result of water filtration from irrigation canals or flooding of the area with waste water when irrigating other crops. In some sites, waterlogging of the root-inhabited layer is caused by groundwater which, in certain sections during the winter and spring season, reaches close to the soil surface.

According to some researchers, the root system of mahaleb cherry is highly sensitive to asphyxia (more than that of peach). Under soil waterlogging during the dormant period, the active roots of mahaleb die after 70–80 days, and during the vegetation period – after 4–6 days. This was confirmed by our studies: under waterlogging of the root-inhabited soil layer to full field capacity, two-year-old trees of the cultivar Koziarska grafted on selected forms of mahaleb died around the 35th–42nd day, and on one of the forms – around the 26th day.

Typical visual symptoms of root asphyxia (root suffocation due to lack of oxygen) are: death of root hairs and subsequently of active and transitional roots, accompanied by darkening and finally decomposition of the cortex.

Under soil waterlogging one of the reactions of grafted trees is cessation of shoot growth, yellowing and premature shedding of part of the leaves, starting from the base towards the tip of the shoots. In this way individual trees react, while in others only a small percentage of the leaves turn yellow and fall; the remaining ones curl around the midrib and thus dry out without detaching from the shoots. They dry in a green state or acquire a yellow-green colour. In some trees the leaves along the venation become orange-red or fade with a light orange tint.

### **Incompatibility between rootstock and scion**

Another cause of premature death of cherry trees is late incompatibility of mahaleb with some cultivars, which manifests itself in the 6th–10th year after planting. A prerequisite for partial manifestation of late incompatibility is the great diversity of forms of mahaleb and the heterogeneity of seedling generations. Fruit tree nurseries in our country still use seedlings obtained from mixed sowing of various unstudied forms of mahaleb as rootstocks, which is probably the reason for the observed tree deaths due to late incompatibility.

The symptoms of incompatibility in some cases are expressed in premature yellowing, reddening and leaf fall in autumn, and in others – in suppressed growth, abundant formation of flower buds, deteriorated fruit quality and subsequent death of the trees. Excessive swelling above or below the graft union is not always accepted as an absolute sign of incompatibility, since it is sometimes observed in compatible combinations as well.

Incompatibility manifests itself more rapidly and to a greater extent when the site conditions are unfavourable for growing mahaleb cherry.

### **Drought during the first years after planting**

Death of young cherry trees due to drought is most often observed during the first 2–3 years after planting, since they are not sufficiently rooted – the roots are still shallowly located in the soil. A higher percentage of mortality occurs in the first year, when the trees are planted in spring with swollen or developed buds and then prolonged soil drought is allowed. Therefore, when planting trees in spring, irrigation must be more frequent, i.e. the soil should be kept in a moist state so that new primary roots can form and good rooting and development can be ensured. Of course, regular irrigation is also necessary for trees planted in autumn. During the following 2–3 years there is also a risk of tree death if prolonged summer soil drought is allowed.

During the prolonged summer drought in 1993, accompanied by high temperatures (above 35°C) and low relative air humidity (51–57%), we observed the death of individual fruit-bearing trees. We found that trees overcome soil water deficit and high temperatures more easily when they have lower fruit load and are timely “relieved” of their fruit burden.

The reaction of trees to air and soil drought is expressed in different ways: yellowing and shedding of part of the leaves, drying of entire shoots without the leaves turning yellow. In individual trees the shoots dry together with the fruits and the tree dies, while in others individual semi-skeletal branches and twigs in the main part and at the tops of the crown die. After cutting out the dry branches and twigs and coating the wounds with oil-based paint or another wound dressing, most of the trees restore their vitality.

### **Diseases**

**Bacterial canker (blight) - *Pseudomonas syringae***

Characteristic of this disease are the injuries on the trunk, scaffold branches and limbs. Around the damaged area a depression or swelling of the tissues is noticeable. The bark is darker in colour, shiny and greasy. In most cases it is torn at the site of damage and the wounds are covered with gum, but cankers without gum are also observed. When the bark is peeled off at and around the infection site, the cambium and wood are seen to be dark brown in colour. In infected trees, the buds do not develop in spring, remain dry and are covered with gum. Symptoms on leaves and fruits are observed more rarely. Under favourable conditions for the development of the disease and in the absence of control, it gradually affects the whole tree. Initially individual twigs and scaffold limbs dry out, and later the whole tree.

When damage caused by the bacterium is established, measures must be taken to prevent its spread. For this purpose, immediately after harvest, pruning is carried out to remove infected twigs and branches. This period is the most suitable for pruning because the trees are in active vegetation and are more resistant to the disease, while the bacterium is weakly active and does not cause new infections during these months. After pruning, the wounds are coated with oil-based paint with the addition of funguran, Kocide or Champion. Control against this disease is carried out in autumn during mass leaf fall and early in spring before bud break. These are the periods when the main infections by the bacterium occur. For autumn and spring spraying one of the following fungicides is used: Bordeaux mixture – 1%, Funguran OH 50 WP – 0.4%, Champion WP – 0.4%, Kocide 2000 WG – 0.4%.

**Bacterial crown gall - *Agrobacterium tumefaciens* (*Rhizobium* spp.)**

The bacterium causing this disease attacks the roots and the root collar, where initially small tumours appear, which have a granular structure and pale yellow colour. The tumours grow rapidly and reach the size of a cabbage head. At first they are smooth and soft, later they darken and harden. In the following year the tumours usually disintegrate and their place becomes an entry point for other microorganisms causing rot. The tumours hinder sap flow, as a result of which the trees weaken. Particularly dangerous are those located on the central roots or at the base of the stem.

To prevent the death of trees from this pathogen only healthy planting material should be used, and for disease control in nurseries it is necessary to:

- Establish fruit tree nurseries on areas not contaminated with the bacterium, well drained, with soil acidity (pH) 5.5–6.0;

- Apply crop rotation in fruit tree nurseries, by sowing and growing cereal crops for 5–6 years, maize being the most suitable;
- Use only healthy certified material when establishing mother plantations. The root system of healthy material should be treated preventively by dipping in a clay slurry with the addition of 1% copper carbonate, copper oxychloride, Funguran, Champion.

## **Phytophthora root and crown rot - *Phytophthora cactorum***

The most characteristic symptom of this disease is cankerous damage in the root collar zone, where the tissues are watery and coloured orange-red. Control of this fungus is very difficult, therefore planting of healthy planting material is recommended, as well as establishing new orchards on suitable terrains.

Less frequently, but verticillium wilt, cytosporosis and honey fungus also cause death of cherry trees.

## **Verticillium wilt - *Verticillium dahlia***

Damage caused by this fungus is established after a transverse cut of the branches and stems, where the wood is seen to be brown.

**Cytosporosis - *Cytospora cincta***, a fungus whose fruiting bodies – small warts – are formed on infected parts. This pathogen infects weakened and injured trees.

**Honey fungus - *Armillaria mellea***, can be recognised by the funnel-shaped mushrooms with honey-yellow colour that appear at the base of infected trees. This disease is usually observed in cherry orchards planted near forest stands.

Before planting a cherry orchard, you must necessarily take into account several factors:

- Proper selection of the site for the new orchard, in accordance with the biological requirements of the cherry for the climatic factors of the region, and the terrain and soil conditions;
- Depending on the soil conditions of the chosen site, select the most suitable rootstock, taking into account the specific requirements of the individual cherry rootstocks;
- Plant certified planting material, i.e. free from viral and bacterial diseases and true to cultivar;
- Considering that premature decline of cherry trees may be caused by pathogens or have a non-infectious character, expert opinion in this field should be sought in order to provide specific recommendations for possible overcoming of an infectious disease or of causes of technological nature.