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How to plant a fruit garden?

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Fruit orchards occupy the same area for a long time. Their establishment requires significant financial investment and labor, which obliges producers to comply with the basic requirements of the individual crops. Furthermore, they must also consider modern consumer demands for fruits free of pesticide residues, as well as the protection of soil and water from pollution.

Sites for new orchards must meet the biological requirements of the fruit species and variety. Unsuitable for fruit orchards are locations where winter temperatures fall below the critical thresholds for a given fruit species, and summer temperatures rise above 35-37°C. In these locations, late spring frosts should not occur more than twice in 10 years. Establishing orchards in areas where hail falls more than twice in 10 years, or where there are strong winds during fruit set and ripening, is not recommended.

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Suitable terrains are river valleys, foothills of mountains and hills, but without steep slopes - up to 6° for apple and pear and up to 10° for stone fruit species. Soils suitable for fruit orchards must be sufficiently aerated, with good water-holding capacity and permeability. These requirements are met by alluvial-meadow soils, typical leached chernozems, cinnamon forest, and gray forest soils.

The groundwater level should not rise above 80-100 cm from the soil surface. Waterlogged, saline, and eroded soils are not suitable for fruit orchards. Orchards should not be established on soils contaminated with heavy metals and other chemically hazardous elements (near heavily trafficked roads or industrial enterprises emitting dust or other pollutants).

For up to 4 years, fruit orchards should not be established on sites previously occupied by the same species. It is very important that fruit orchards are established on areas free from crown gall infection caused by *Rhizobium radiobacter syn. Agrobacterium tumefaciens*.

The most reliable way to reduce pesticide use is the selection of varieties that are resistant or less susceptible to economically important diseases.

When establishing an **apple orchard**, it is very important to know that apple scab (*Venturia inaequalis*) causes the greatest damage to producers, a problem that can be solved by planting resistant varieties. Over 150 scab-resistant varieties have been developed worldwide – among the more widespread are: Prima, Priscilla, Sir Prize, Liberty, Jonafree, Redfree, Freedom (developed in the USA); Macfree, Novamac, Moira, Brightgold (Canada); Florina, Judeline (France); Pionier, Romus-1, Romus-2, Voines (Romania); Rubinola, Topaz, Rajka (Czech Republic); Gavin (England); Rebola, Regine, Rewena, Reglindis (Germany), of which Rebola is also resistant to fire blight.

Most apple varieties with very good taste qualities and in demand on the market are susceptible to scab, but they also differ significantly in their susceptibility to this disease. It has been established that the degree of scab attack on apple varieties varies widely - from 7-9% in Oregon Spur, Rosana, etc. to over 50% in Golden Delicious, Goldjon, Granny Smith, Fuji, etc. The large difference in varietal susceptibility to scab necessitates conducting a different number of sprays to protect trees from the disease. For scab-resistant varieties, treatments against the disease are not required, while for the remaining varieties, from 8 to 14 treatments are needed depending on meteorological conditions during the year and the degree of varietal susceptibility.

Regarding susceptibility to powdery mildew, apple varieties also differ significantly. The degree of attack on leaves and shoots ranges from 0.88% in Kolotni to over 80% in Moira, Jonathan, and Jonafree. To protect less susceptible varieties from powdery mildew, a minimum of 2 and a maximum of 4 sprays are conducted, while for highly susceptible ones - from 5 to 10.

Plum pox virus (Sharka) is the most harmful disease of **plum**, caused by a virus. To date, the only way to prevent damage from Sharka is planting plum varieties resistant or tolerant to the disease.

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The variety Jojo is resistant, while varieties like Stanley, Čačanska najbolja, Čačanska lepotica, Althanova renkloda, Hanita, Tegera, etc. are tolerant.

Cylindrosporiosis (*Blumeriella jaapii*) on **sweet cherry** is one of the economically important fungal diseases, but unlike apple, there are no bred resistant varieties for it. Results from long-term studies on the susceptibility of sweet cherry varieties to cylindrosporiosis show that all varieties are susceptible to the disease, but to varying degrees, ranging from 15-16% in Pobeda and Vik to 80% in Bing. Studies show that the number of sprays for less susceptible varieties can be reduced.

The **sour cherry varieties** grown in our country also differ in their susceptibility to brown rot blossom blight caused by the fungus *Monilinia laxa*. Varieties such as Érdi Bőtermő and Heimanns Rubin are highly susceptible to the disease.

Brown rot on **sweet and sour cherry** (*Monilinia* sp.) is also a serious problem in years with frequent rainfall during fruit ripening and harvest. In sweet cherry, fruit cracking is the main reason for infection by rot pathogens. To reduce fungicide treatments and losses from rot, varieties that are relatively resistant to cracking are recommended. In numerous publications from various European countries, varieties such as Lapins, Regina, Sam, Germersdorfska, Merton Marvel, Castor, Kordia are indicated as less susceptible to cracking.

In some years, peach leaf curl (*Taphrina deformans*) on **peach** causes significant damage to producers. So far, among the varieties grown here, there are none resistant to the disease, but there are some such as Redhaven, Benedicte, Roter Ellerstädter, Suncrest, etc., which are less severely attacked.

The number of treatments against diseases and pests on fruit species during the growing season depends on a number of factors such as varietal susceptibility to economically important diseases, the conditions for disease and pest development (more precisely, humidity and temperature, which also depend on the location).

Before establishing fruit orchards, much thought must be given not only to the selection of varieties but also to the planting scheme, especially if the orchard is mixed. When arranging species and varieties, it is imperative to consider pollination and the protection of trees and the fruit crop from pests. A well-considered orchard planting scheme is a prerequisite for reducing pesticide use throughout the cultivation period of the fruit species.

The varying susceptibility of apple, pear, sweet cherry, sour cherry, and plum varieties to the economically most important diseases, the different fruit ripening times, and flowering phenophases allow for the application of differentiated plant protection. This avoids unnecessary sprays on individual varieties.

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Differentiated plant protection requires that fruit orchards be established according to schemes that consider varietal susceptibility to diseases and fruit ripening times.

All of this can be substantiated with specific examples for individual species.

For apple varieties resistant to scab (listed above), treatments against scab are not required, while for the remaining varieties, from 8 to 14 treatments are needed depending on meteorological conditions during the year and the degree of varietal susceptibility. In plantings with highly susceptible and scab-resistant varieties, they must be arranged so that they can be sprayed differentially.

The same requirement must be observed regarding varieties with different susceptibility to powdery mildew, considering that to protect less susceptible varieties from powdery mildew, a minimum of 2 and a maximum of 4 sprays are conducted, while for highly susceptible ones - from 5 to 10.

The main pest in bearing apple orchards is the codling moth (*Cydia pomonella*), against which sprays must be conducted annually. In most apple-producing regions of the country, the control scheme for codling moth is 2 + 2, and in some years 2 + 3, when broad-spectrum insecticides are used. In practice, the sprays are 3 + 3 for the first and second generation, respectively, because some of the sprays against San Jose scale coincide with those against codling moth. The ripening of fruits of summer varieties usually begins at the end of July – Vista Bella or August – Mollies Delicious, Prima, etc., which creates problems in protecting apples from codling moth and San Jose scale in orchards where the planting scheme does not allow for differentiated sprays. In such orchards, even after harvesting the fruits of summer varieties, tree treatment against codling moth continues due to the impossibility of excluding them, which not only increases the cost of fruit production but also unnecessarily pollutes the environment. In orchards where the planting scheme allows for varietal plant protection, two insecticide treatments are eliminated for summer varieties. All of this also applies to the pear and plum fruit moths.

Results from conducted studies show that the number of fungicide sprays on sweet and sour cherry for less susceptible varieties can be reduced by applying differentiated plant protection. For varieties highly susceptible to brown rot blossom blight such as Érdi Bőtermő and Heimanns Rubin, 2 bloom sprays must be conducted, while relatively less susceptible ones can be protected with one bloom spray.

The cherry fruit fly (*Rhagoletis cerasi*) exhibits selectivity regarding the degree of fruit maturity when laying eggs. It has been established that it prefers to lay eggs in ripening fruits, which is why in most years it does not cause worm infestation in early-ripening sweet cherry varieties such as Ranna Cherna Edra, Seneca, Bigarreau Burlat, Early Lory, Kosara, etc., for which spraying is not required. For mid-season ripening sweet cherry varieties, one spray is required, and for late-ripening ones, two sprays against this dangerous pest.

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At high density of the hairy beetle (*Epicometis hirta*) in sweet cherry, sour cherry, and apple plantings during the period of initial and rapidly increasing fruit set, a spray should be conducted during the phenophases of flower bud, which occur differently for different varieties. This also necessitates conducting differentiated control to be effective.

Growers who wish to reduce pesticide use in fruit species should seek the advice of horticulture and plant protection specialists when choosing the site, suitable species and varieties, and designing the planting scheme for the fruit orchard.