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Fruit Trees and the Environment

- Requirements of fruit trees on environment in the Czech Republic:
  - General (common requirements of all fruit species)
  - Specific (directly linked to environmental history)

Majority of fruit species are light-requiring and heat-requiring

They are well adaptable to environmental factors. Profitability of cultivation is commonly related to optimum scope of the plantings

Environmental factors

Natural conditions make up certain external conditions which are called environmental factors. Environmental factors do not affect the tree separately but affect it together.

Common classification:

a) Climatic factors

b) Soil factors

c) Geographical factors (topographical)

d) Biotic factors (impact of plants, animals)

e) Anthropogenic factors (impact of humans and civilization)

ad a) Climate: Light, heat, water, air, air humidity, precipitation

ad b) Soil: Physical, chemical and biological properties of soil

ad c) Geography: Latitude and longitude, altitude, configuration of the terrain (exposition – amount of sun absorption, inclination – slope, inclination angle, gradient)

- ad d) Biotic factors: Water bodies, forests, meadows, pastures, cities, affect of mountain ranges in close vicinity
- ad e) Anthropogenic factors: Plantings density, shape of crowns, chemical and biological protection, shape, size and accessibility of the land

In terms of altitude, locations may be divided into:

- - Lowland regions
- - Midland regions
- - Foothill regions
- - Mountain regions

Locations according to the nature of surroundings:

- Protected
- Windward
- Closed

Quadrant locations:

- South
- North
- East
- West

Terrain configuration:

- Plains
- Slopes

Territorial planning

Fruit tree territorial planning includes selection and classification of regions suitable for growing of fruit trees

There are four zones describing suitability of fruit trees:

1. First zone: Optimum conditions of all environmental factors affecting fruit tree cultivation
2. Second zone: Environmental factors with indirect impact are not distributed evenly; proper cropping practice may result in regular and good-quality yield
3. Third zone: Good for hobby gardeners
4. Fourth zone: Not suitable for fruit tree cultivation

Commercial fruit tree cultivation deploys first and second zones

Locations with previously successful cultivation of fruit trees are preferred when selecting new stands; expansion of cultivation will face similar conditions

Current tendency to grow heat-requiring fruit trees (apricot, peach, walnut) in colder regions is questionable (potential change in current trend of global climate warming might cause a serious damage)

Delicate fruit trees: Almond tree, peach tree, walnut tree (-18 through -25 °C). Apricot tree is a bit more resilient.

Resilient fruit trees: Pear tree, cherry tree, sour cherry tree, plum tree, apple tree

(-20 through -30 °C)

Resilient fruit trees: Red currant, white currant, gooseberry (below -30 °C)

Protection against frost-damage:

- Preventive measures, selection of growing region and stand
- Proper cropping practice

- Protection against pests and diseases
- Adequate nutrition
- Decrease in soil water – end of vegetation
- Productiveness control – thinning of fruit set
- Elimination of plant shadowing
- Virus-free planting material
- Prevention against local heating of the trunk by sun

Requirements of fruit species on environment

Apple tree

- Highly tolerant to climate up to 600 m above sea level
- Decisive factor: soil conditions, water table, soil profile, precipitation
- Suitable lighter soil, sufficiently deep, aerated, permeable, rich in nutrients
- Neutral pH
- Windward locations and frost pockets are not suitable
- Optimum mean annual temperature: 7-8 °C, precipitation: 600-800 mm

Pear tree

- Warm and medium warm regions, intolerant to pollution with SO_2
- Soil: Deep, medium heavy, permeable, rich in nutrients
- Intolerant to high content of soil carbonates (quince rootstock), low frost-resistance

- Granny Smith

- Protected locations, good air flow, intolerant to inverse locations
- Optimum annual mean temperature: 7.5-9.0 °C; precipitation: 500-600 mm

Plum tree

- High requirements on air humidity and amount and distribution of precipitation, average precipitation: 600 mm
- Soil: Fertile, warm, sufficiently aerated, prefers abundance of soil moisture to its lack
- Myrobalan plum rootstock tolerates low nutrient soil but suffers from winter frost
- Planting: plain land and slopes, southwest and west orientation
- High August precipitation cause fruit cracking and brown rot

Cherry tree

- Heat-requiring species
- Warm and dry regions, annual mean temperature: 7.5-9 °C, annual precipitation: 600 mm
- Soil: Lighter, permeable, even gravely; heavier soil causes high tree mortality
- Intolerant to high water table and waterlogged soil
- Optimum: Protected locations, southwest, south and southeast slopes

Sour cherry tree

- One of the least demanding fruit trees, sour cherry tree may be grown in all fruit-growing regions
- Optimum: loamy-sandy soil, sufficient moisture, tolerant to soil pH

- High frost-resistance of both wood and blossoms, planted in less favourable locations, variety must be properly selected
- Dry locations require use of mahaleb cherry tree rootstock
- Heavy, waterlogged soil is inappropriate

Apricot tree

- Optimum: Mean annual temperature above 8 °C, average precipitation above 500 mm, and altitude of 200-250 m
- Slope terrain, protected from north and northeast winds, is an optimum location
- Appropriate: Locations facing south, southwest, and west
- Optimum: Medium heavy, sandy-loamy and loamy soils with max. 40 % clay content, rich in air
- Requires adequate amount of Ca in soil, and max. 10 % of $CaCO_3$

Peach tree

- Good: Warm regions, mild slopes facing south, southwest and southeast
- Altitude of 200-250 m, average precipitation 500 mm, arid regions require irrigation
- Medium heavy, sandy-loamy to loamy soil, 20-40 % clay, mediocre amount of nutrients and 1.5 % humus
- Neutral to slightly alkali soil, max. 5 % $CaCO_3$, higher amounts cause chlorosis
- Inappropriate: Waterlogged, clay soil with high water table

Currant

- Red and white currant
- Optimum growth: Sandy-loamy soil with sufficient amount of moisture

- Optimum: Open location, medium to high locations; inappropriate: sun-exposed south slopes, frost pockets
- Versatile varieties: Ribes multiflorum group
- Warmer regions: Varieties from the Ribes rubrum species
- Wet regions: Ribes petreum

Black currant

- Higher requirements on soil and climate
- Deep, sandy-loamy soil; low and medium-high locations with enough moisture and nutrients
- Tolerant to calcareous soil
- Intolerant to windy locations and sun-exposed south slopes

Gooseberry

- Higher requirements on soil: Loamy, loamy-sandy, calcareous, enough moisture
- Higher requirements on moisture than currant; more resistant to lower temperatures
- Intolerant to acidic, heavy, clay, excessively wet soil
- Suitable: Open locations with mild air flow - no fungi diseases, powdery mildew of currant
- Benefits from half-shade

Raspberry

- Prospers in basically all fruit-growing regions, requires sunny locations
- Soil: Medium heavy, permeable, humus, slightly acidic, loamy and loamy-sandy
- Inappropriate: Heavy, waterlogged as well as easily desiccated
- High requirements on soil moisture - grow in foothill regions with annual precipitation of 800 mm

Blackberry

- Warm, sunny locations protected against wind
- Soil: Medium loamy, permeable, sufficient moisture, slightly acidic to neutral

Strawberry

- Versatile, may be grown in basically all regions
- Flourishes in southwest slopes (sun-exposure, warmth and moisture)
- Suffers in south and east locations as well as frost pockets
- Average precipitation: 600-700 mm, additional irrigation
- Remontant varieties benefit more from warmer regions
- Varieties cultivated for Central and Western Europe: good for growing in the Czech Republic