



INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ



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## Vineyard Floor Management

- Vineyard floor management must have positive impact on growth and development of the grapevine
- No stress and negative impact on yields and quality of grapes
- Must promote biological processes in soil and formation of organic matter
- Must maintain good humus in soil

- Vineyard floor management must consider:
- Specific conditions at the vineyard and grapevine requirements
- Soil conditions
- Water-holding capacity of the soil
- Amount of precipitation and its distribution during a growing season
- Sun exposure and vineyard slope

- According to ZIEGLER (2004), all cover crops consume some portion of available water (100-150 L per 1 m<sup>2</sup> during a growing season, in ascending order):
- Mulching of organic material – straw, bark
- Cover crops during winter, dead fallow during summer
- Rotating cover crops – biennial cover crops in interrows
- Partially permanent cover crops – cover crops in every other interrow
- Permanent cover crops in all interrows

## Conventional methods of vineyard floor management

- Dead fallow; frequent soil processing supplies oxygen, and decreases humus in soil and soil fertility
- Humus decomposition releases nitrogen, and adds nitrogen into the system
- Cover crops in the vineyard promote good soil properties. Intensive root system in vineyards enhances good soil structure and biological soil stability, and allows for increased soil microbial populations.



- Cover crops reduce soil erosion on slopes and have positive impact on microclimate
- Cover crops prevent soil integration and compactness
- Selection of proper cover crops depends on expected duration of the crops (annuals, biennials, perennials)

## Significance of humus for cover crop systems

- Content and composition of organic matter depends on fertilization and vineyard floor management
- Certain parts of the grapevine (canes, leaves, stalk) are a source of organic matter
- Development of microorganisms in soil is enhanced by sufficient amounts of organic matter, and symbiosis of legumes with nodule bacteria or mycorrhiza

- Accessible nutrients are released from organic matter via the process of mineralization; low humus content has negative impact on main soil functions (remedy: cover crops, green manure)
- Amelioration annual / biennial cover crop mixtures increase humus concentrations in soil and enhance soil fertility.



## Vineyard floor management – new vineyards

- Minimize weed, reduce any competition of the grapevine
- Dead fallow on the whole site area is a conventional vineyard floor management in the year 1 and 2 after the plantings
- Cover plants cannot compete with grapevine. Cover plant system is usually applied over the winter, cover plants in some of the interrows during a growing season – in year 2 after vine planting
- New plantings with low humus content: mixtures with high share of legumes (Fabaceae family); winter coverage - cereals

## Vineyard floor management – dead fallow system

- Dead fallow all over the vineyard floor was a conventional method of vineyard management
- Regular, mechanical soil management helps decrease humus content in soil and soil compactness, chlorosis outbreaks and erosion problems
- Ill-timed operations of machinery in the vineyard increase soil compactness, damage soil texture, and have a negative impact on soil porosity (which affects root system and intake of water and nutrients)
- Aeration of upper soil layers (4 – 6 cm) disintegrates soil pore capillaries and reduces non-productive evaporation of soil

## Vineyard floor management systems

- Opt for systems which drain least water from the soil and enrich it with organic matter
- Cover plants in vineyard in appropriate time
- Partial coverage – coverage of every other interrow
- Planting of cover plants in July-Oct
- Partial coverage over winter (Aug-Apr)
- Spring coverage (March-June)







- Cover plants planted in July-Oct: Legumes and brassicas, sensitive to winter frost (sown at the end of July, early Sep)
- Partial coverage over winter: Protection against hard frost, promotes biological soil processes, enhances formation of organic matter and management of water and nutrients in soil. Sown in mid-Aug through early Sep; allows for mechanical harvest Application of mineral nitrogen in mid-March – one-off application of mulch in spring, plough back in soil in early May. Mixtures with legumes.





- Spring coverage - planted in March, usually in vineyard until June; ploughed back in soil if there is not enough soil moisture







## Rotation coverage

- Transition between partial coverage and permanent green coverage; dead fallow on every other interrow, and legumes / winter crops in autumn, repeated ploughing with further mulching in a following year, and ploughing back into soil the next spring

## Permanent green coverage in vineyard

- Good for: Vineyards in good condition, soil rich in humus, high precipitation
- Used more for interrows; dead fallow under the vines
- Traditional one-species culture does not offer conditions for development of useful soil microorganisms
- Mixtures should be diverse with few grass species from the true grass family
- Coverage comprising high share of legumes may bind 56-224 kg of N per ha, and may significantly contribute to the overall nitrogen balance in the vineyard



- Sowing of legumes in spring (Apr) or autumn (Aug, Sep); typical mixture of legumes is called Rebenfit
- 30-35 kg of mixture per 1 ha of vineyard
- Other group of cover crops with high share of biomass for partial coverage: brassicas (most common species from the true grass family – good soil stability)

- Partial and permanent coverage mixtures with dicotyledons flowering herbaceous plants (sunflower, wild chamomile, yellow chamomile, oxeye daisy, tansy, common yarrow, wormwood, lovage, buckhorn, flax, parsley, purple tansy, buckwheat, tall mallow, etc.)

## Sowing of green coverage mixtures

- Good timing – spring, summer, autumn
- Spring sowing (mid-March till the end of April) – use of winter soil moisture and spring precipitation
- Summer and autumn sowing – end of July till Sep (precipitation is more common)
- Sowing area must be aerated, not too deep (10-15 cm)

## Management of vineyard cover crops

- Basic management – mulching and mowing
- Impact on vineyard ecosystem:
- Decrease in evaporation of soil and retention of water
- Improved soil texture in surface layers
- Supply of organic matter to the soil, improvement of nutrient intake
- Slower heat warming, root growth is decreased

- Increase in occurrence of spring and autumn frosts, and their negative impact on the vine
- Cover crops are ploughed back in soil (depends on nitrogen requirements of grapevine), max. 20 cm deep



## Organic mulches

- Positive impact on formation of organic matter in soil, reduce evaporation and decrease soil compactness and erosion problems
- Straw, crushed bark, pruned vine shoots, hay (shortly, from spring till the following year spring)
- Crushed bark mulch – 8-10 cm layer, lasts 3-5 years, phenols inhibit weed growth
- Straw mulch prevents erosion, suppresses weed growth, and keeps soil moisture; dosing: 80-100 tons per ha

## Management of vineyard floor under the grapevines

- Tillage and application of herbicides on dead fallow; system of permanent cover plants
- Most common: Tillage and application of herbicides

- Mechanical tillage of the area under the grapevines
  - Aeration of soil affects vine nutrient intake, and therefore affects the grape quality and yields
- Application of herbicides
  - Applied strictly on the area around the trunks (40-60 cm)
  - Post-emergent herbicides are applied on weed (contact and system herbicides)
  - Grapevine is sensitive to damage during bud break; glyphosate-based herbicides may be applied by the berry set phenophase at latest

## Cover crops in the area under the grapevines

- Prevent erosion and enhance development of useful microorganisms
- Mixtures available on the Czech market: Green - Mix mini, good for permanent coverage of the vineyard (60-80 cm) - sheep fescue, red fescue, common meadow-grass, white clover; sowing amount: 10-15 kg per ha

## Use of mycorrhiza in viticulture

- Cover crops in vineyard may promote development of mycorrhiza fungi
- Mycorrhiza may enhance water management in vineyard; arbuscular mycorrhizae fungi is important for intake of minerals with low mobility in soil (phosphor, zinc, copper); positive impact on other nutrients
- Nitrogen, potassium, calcium, magnesium, sulphur, iron