



INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ



**Inovace studijních programů AF a ZF MENDELU  
směřující k vytvoření mezioborové integrace  
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**Tato prezentace je spolufinancovaná z Evropského sociálního fondu a  
státního rozpočtu České republiky**

# Grapevine pruning and training

# Grapevine pruning

- Pruning: Most important work in a vineyard (and the most expensive and time consuming)
- Grape quality and quantity depend on quality and technique of pruning
- Optimum grape quality relies on many factors:
  - Vineyard site selection, soil, climate, year, yield, vineyard management, grape ripeness

## Objectives of pruning:

- Maintain optimum vine shape
- Keep optimum vine productiveness and production of excellent grapes
- Pruning determines amount of fertile buds on the vine:
  - Amount of buds per 1 m<sup>2</sup> of vineyard – calculated to spacing = amount of buds per vine
  - Intensity of vine growth relies on amount of buds left after pruning, i.e. amount of future annual shoots (and amount of grape clusters)
  - Amount of reduced buds (grape clusters) = increase in size of clusters and berries = improved quality

- Pruning maintains balance in growth and fertility of the vine (excess nitrogen may also affect the development)
- Unnecessary, extra wood is eliminated
- During the first 4-5 years, young vines must be loaded with a crop gradually

- Thickness of annual shoots and intensity of their growth are good indicators for optimum amount of buds of the vine, i.e. for pruning
- Excessively fertile vines postpone maturity and decrease quality of the berries
- Excess crop decreases vine growth even for several years (weak, short annual shoots)
- Vine with inadequate productiveness (few fertile buds) lack optimum sugar content – defects in balance: congested plant, vigorous growth, poorly mature wood, etc.

# Pruning classification

- Seasonal pruning
  - Autumn pruning
    - After grape harvest and leaf fall – Nov, Dec
    - Autumn pruning is not recommended
    - Pruning cannot be adjusted to the frost-damage
    - Suitable only for inadequate labour capacities
  - Winter pruning
    - Commonly in Jan-Feb, if weather allows
    - Pruning may be partially modified to reflect the course of a winter
    - Suitable only for inadequate labour capacities

- Early spring pruning
  - Mid-Feb till mid-March
  - Physiologically the most suitable and also most common pruning
  - Frost-damage is obvious at that point and pruning may reflect that
  - Unpruned vine is more tolerant to winter frost thanks to better management of reserve substances stored in the wood
- Late spring pruning
  - Until lymph starts to circulate – end of March
  - Practiced in areas with late spring frosts
  - Unpruned vine sprouts later
- Summer pruning
  - Tipping: Reduction of annual shoots at the end of summer in August (terminates elongation growth and improves buds maturity)

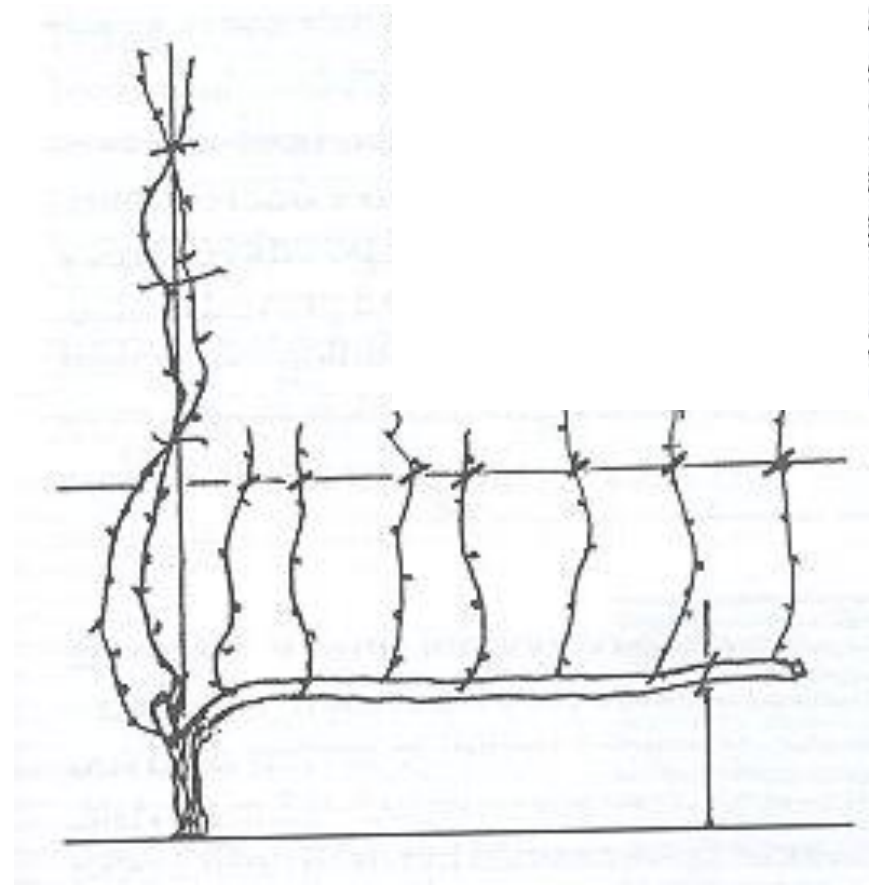


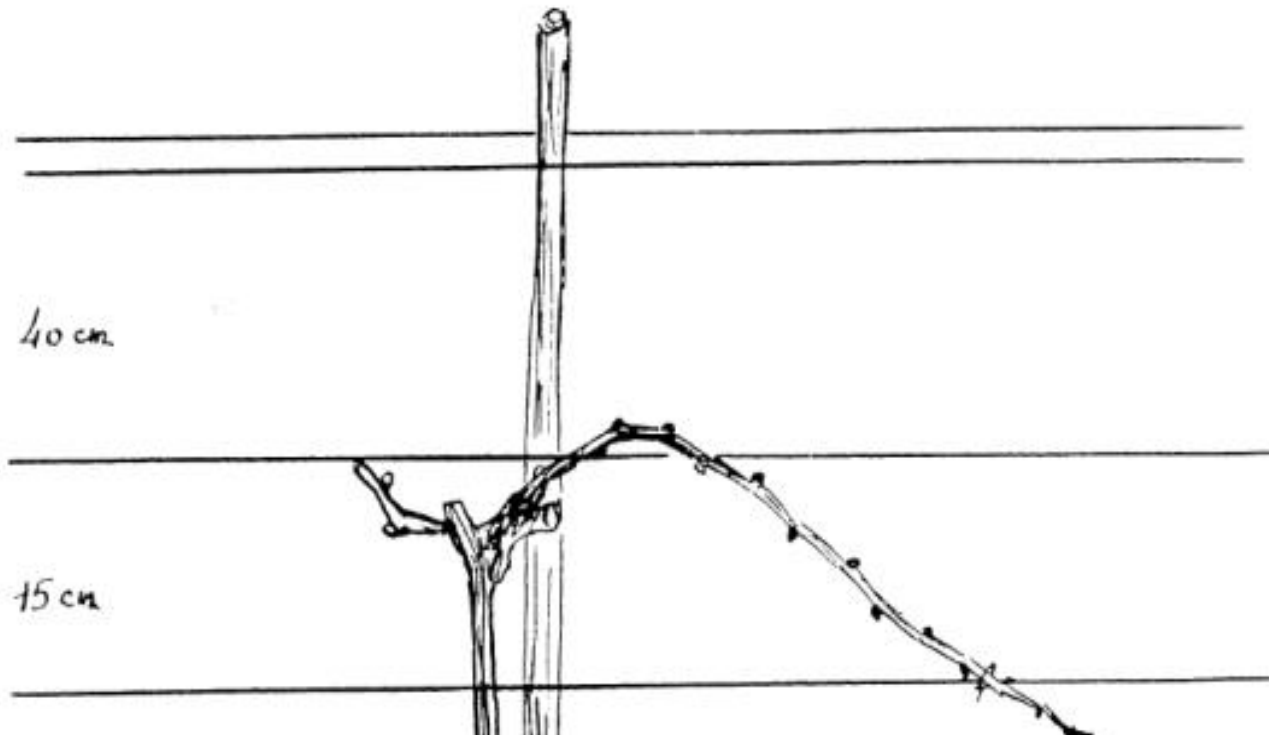
# Pruning technique

- Short pruning: 1-5 buds, spur pruning – only short, basal parts are left; number of left buds:
  - Short spurs – 1-2 buds
  - Medium spurs – 3-4 buds
  - Long spurs – 5 buds
- Medium pruning: 6 to 8-bud semi-long pruning
- Long pruning: 9 to 14-bud cane pruning

## Mixed pruning:

- Spur pruning, semi-long pruning as well as cane pruning
- Guyot pruning system
  - 1. Leave a 2-bud renewal spur down on the head of the vine
  - 2. Leave a a cane or semi-long cane above the spur





2-bud renewal spur

- Growth
- a renewal cane

Cane, semi-long cane

- Productiveness

## Specifics of grapevine growth

- Vine-like growth
- Vine requires a support - wire supports, special constructions, pergolas, etc.
- Polarity
- Most vigorous growth occurs close to the growing point; this is suppressed by pruning, bending and tying of the canes
- Vine bleeding
- End of Mar, early Apr
- Sap pours out of cuts and wounds, up to 10 L per vine, nutrient loss
- Growth correlations
- Significant relations between individual organs (root system / aboveground parts)
- The more of the aboveground parts we remove, the more the vine grows

## Functions of plant wood parts

- Old plant wood part
- 3-year old wood and older (head, trunk, arms)
- Nutrient storage; water, nutrient, and assimilates circulation
- Vigorously growing varieties require more of old wood (Sauvignon, Gewurztraminer, Limberger, Rhine Riesling, table varieties)
- Less vigorous varieties require little old wood parts (Silvaner)
- Requirements on trunk: Erect, no damage, mature, no cutting wounds

## Two-year old wood

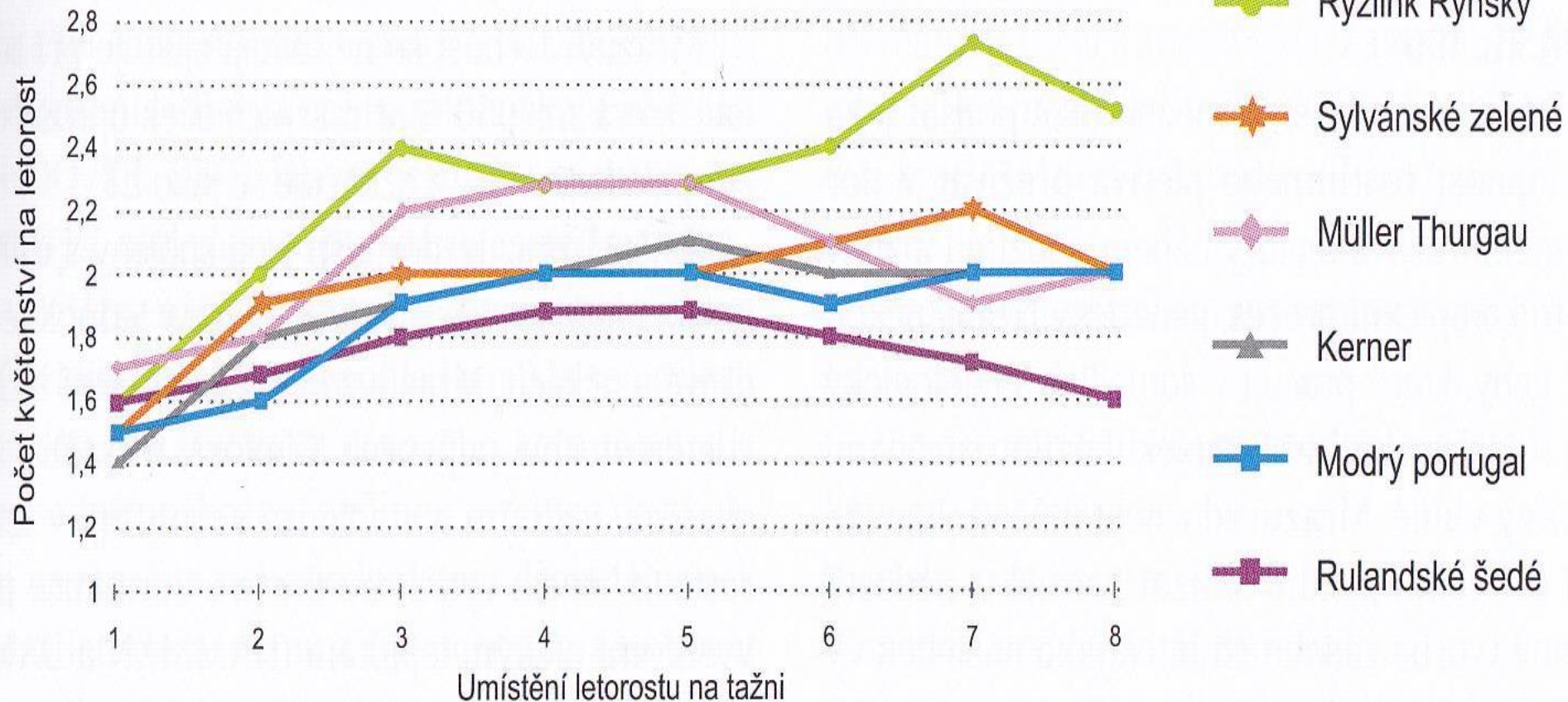
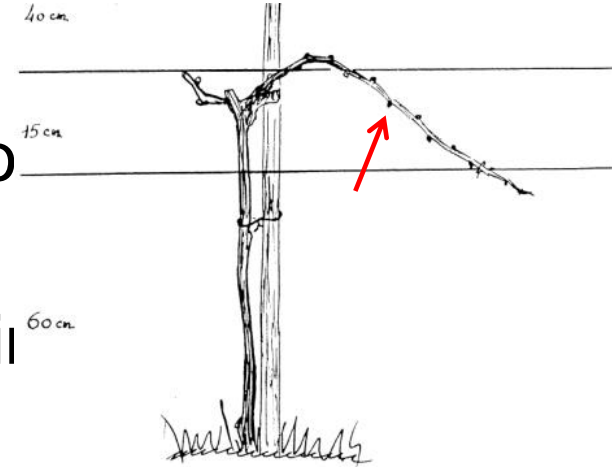
- Develops from last-year canes, semi-long canes or spurs
- Affects fertility of one-year old wood: One-year old vine shoots growing from two-year old shoots are always more fertile

## One-year old wood

- Lignified annual shoots after leaves have fallen off
- Remains on the vine as a fertile wood – cane, semi-long cane, spur
- One-year old wood should grow from two-year old wood
- Variety-dependent colouring

# Buds

- Biological value depends on a position on an annual shoot
- First three buds are least fertile (1.8 buds per annual shoot on average)



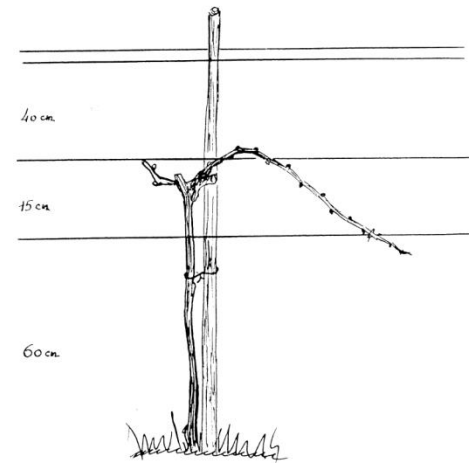
## Lateral shoots

- Development, amount, and intensity of lateral shoot growth depends on a particular variety
- Promote maturity of buds but cause higher vine density
- May be used as fertile vine shoots (the so called Martinské young grapes)



# Selection of fertile plant wood

- Choose one-year old, mature, healthy, damage-free shoots growing on two-year old wood
- Optimum vine shoot diameter: 8-10 mm
- Weak and too thick shoots are not good – long internodes, crack when bent
- Frost-damaged buds cannot be used
- First three buds have best frost-resistance as they are mature (and oldest, too)



## Shoot length (amount of left buds) depends on:

- Variety requirements – fertility – amount of grape clusters and their quality
- Vineyard spacing
- Given rootstock
- Vine age
- Nutrition, training
- For varieties with smaller grape clusters and lower fertility:
- Cane pruning (9-14 buds)
- For varieties with medium to large grapes and higher grape quality:
- Semi-long pruning (6-8 buds)
- For cordons and after mechanical pre-pruning:
- Spur pruning (2-5 buds)

## Recommended amount of buds per vine

- Amount of buds left on the vine depends on variety and vineyard health
- Recommended amount of fertile buds for particular varieties (number of buds per m<sup>2</sup>) – basic parameter for determining pruning
- Amount of buds may be higher for production of grapes intended for quality wine production; and is lower for production of grapes intended for wines with special attributes
- Few buds
- 4-6 buds per m<sup>2</sup>, 40-60 THS buds per 1 ha
- Fertile varieties with large grape clusters
- Green Veltliner, Müller Thurgau, Zweigeltrebe, table varieties

## Medium bud loading

- 6-8 buds per m<sup>2</sup>, 60-80 THS buds per 1 ha
- Very fertile varieties with medium-sized grape clusters
- Frühroter Veltliner, St. Laurent, Limberger

## High bud loading

- 8-10 buds per m<sup>2</sup>, 80-100 THS buds per 1 ha
- Varieties with small grape clusters
- Vrboška, Rhine Riesling, Pinot blanc

- Very high bud loading
- 10-12 buds per m<sup>2</sup>, 100-120 THS buds per 1 ha
- Rarely for:
  - Varieties with very small grape clusters
  - Vineyards with inadequately selected material

White varieties	Loading with fertile buds (buds per m <sup>2</sup> )	Thinning of fruit setting	Leaf thinning	Titrateable acids in grapes (g/L)	Acids in grapes
<b>Aurelius</b>	6–8	Low	Medium	6–8	Medium
<b>Auxerrois</b>	6–8, 8–10	Low	Medium	6–8	Medium
<b>Děvín</b>	6–8	Low	Medium	5–8	Low
<b>Hibernal</b>	4–6, 6–8	Medium	High	7–11	High
<b>Chardonnay</b>	6–8	Medium	Medium	7–11	High
<b>Irsai Oliver</b>	6–8, 8–10	Low	Low	4–7	Low
<b>Kerner</b>	6–8	Low	Medium	7–9	Medium
<b>Lena</b>	6–8	Low	Low	6–8	Medium
<b>Malverina</b>	4–6, 6–8	High	High	8–12	High
<b>Müller Thurgau</b>	6–8	Low	Low	5–8	Low
<b>Muškát moravský</b>	6–8, 8–10	Low	Low	5–8	Low
<b>Muškát Ottonel</b>	6–8, 8–10	Low	Low	6–8	Medium
<b>Neuburské</b>	6–8	Low	Medium	7–10	Medium
<b>Pálava</b>	4–6, 6–8	High	High	5–8	Low

White varieties	Loading with fertile buds (buds per m <sup>2</sup> )	Thinning of fruit setting	Leaf thinning	Titrateable acids in grapes (g/L)	Acids in grapes
<b>Rinot</b>	6–8	Medium	Medium	7–9	Medium
<b>Pinot Blanc</b>	4–6, 6–8	Medium	High	8–13	High
<b>Pinot Gris</b>	6–8	Medium	High	6–9	Medium
<b>Ryzlink rýnský</b>	4–6, 6–8	High	High	8–13	High
<b>Ryzlink vlašský</b>	4–6, 6–8	High	High	8–13	High
<b>Sauvignon</b>	4–6, 6–8	High	High	8–13	High
<b>Green Silvaner</b>	6–8	Medium	High	7–10	Medium
<b>Red Traminer</b>	6–8	Medium	High	5–7	Low
<b>Early red Traminer</b>	6–8, 8–10	Low	Low	5–7	Low
<b>Green Veltliner</b>	4–6, 6–8	Medium	Medium	6–10	Medium
<b>Veritas</b>	6–8	Low	Medium	7–9	Medium
<b>Vrboska</b>	8–10	Low	Low	4–6	Low

Red varieties	Loading with fertile buds (buds per m <sup>2</sup> )	Thinning of fruit setting	Leaf thinning	Titrateable acids in grapes (g/L)	Acids in grapes
<b>Agni</b>	8–10	Low	Medium	5–7	Low
<b>Alibernet</b>	4–6	High	High	9–12	High
<b>André</b>	4–6	High	High	7–10	High
<b>Ariana</b>	6–8	Medium	High	6–9	Medium
<b>Cabernet Moravia</b>	4–6	High	High	6–8	Medium
<b>Cabernet Sauvignon</b>	4–6	High	High	6–9	Medium
<b>Cerason</b>	4–6	High	High	9–11	High
<b>Domina</b>	6–8	Medium	Medium	5–7	Low
<b>Dornfelder</b>	6–8	High	High	4–6	Low
<b>Limberger</b>	4–6	High	High	7–10	High
<b>Fratava</b>	6–8	Medium	High	6–9	Medium
<b>Laurot</b>	4–6	High	High	9–11	High
<b>Merlot</b>	4–6	High	High	7–9	Medium
<b>Portugal</b>	6–8	Medium	Medium	6–8	Medium
<b>Nativa</b>	6–8	Medium	Medium	6–9	Medium
<b>Neronet</b>	6–8	Medium	Medium	6–8	Medium
<b>Rubinet</b>	6–8, 8–10	Low	Medium	5–7	Low
<b>Pinot Noir</b>	4–6, 6–8	Medium	High	8–10	High



Grapevine table varietes	Recommended loading (buds per m2)
<b>Arkadia</b>	4–6
<b>Diamant</b>	4–6
<b>Chasselas Blanc</b>	6–8
<b>Chasselas Rose</b>	6–8
<b>Julski biser</b>	6–8
<b>Olšava</b>	4–6
<b>Panonia Kincse</b>	4–6
<b>Pola</b>	4–6
<b>Vitra</b>	4–6

High amount of buds not corresponding with vine capacity may result in:

- Poor growth of annual shoots
- Limited photosynthesis
- Insufficient grape clusters development, low quality
- Worsened vine shoot maturity
- Worsened vine life

Low amount of buds not corresponding with vine capacity may result in:

- Very vigorous growth of annual shoots and leaf surface, imbalance (congested vine)
- Thick annual shoots
- Less fertile
- Hard to train
- Prone to frost damage
- Very high grape yield, low quality
- High susceptibility to fungi diseases

## Manual pruning

- 1. Garden shears
  - Time and labour consuming:
  - 15-20 cuts per vine
  - Worker performs 6-8 thousand cuts per shift
  - 65-90 thousand cuts per 1 ha
- 2. Pneumatic pruning shears
  - Blades are controlled by air pressure
  - Stand-alone compressor, or mounted onto a tractor
  - Drawback: Pressure hose gets in a way

### 3. Electrical pruning shears

- Blades are controlled by electric impulses
- Battery is attached to a worker

### 4. Lever pruning shears

- Removal of old plant wood
- Replaces handsaw

### 5. Handsaw

- With a frame and a reversible blade
- Without a frame

## Costs of manual vine pruning

- Time: 70-160 hours per ha (depends on variety, spacing and type of wire support)
- Costs per pruned vine: CZK 2-3
- Costs per 1 ha: CZK 6,000-11,000

## Manual pruning procedure

- Select a suitable one-year old vine shoot for cane pruning and spur pruning
- Remove old, non-fruiting canes as well as unnecessary one-year old vine shoots (up to 90 % of the vine)
- Prepare additional two-bud spurs
- Cut new, properly long canes
- Cut vine shoots 15-20 mm above the last intended bud
- Make a smooth cut, perpendicular to the vine shoot axis
- Remove new canes from tendrils and lateral shoots
- Remove overmature and damaged plant wood

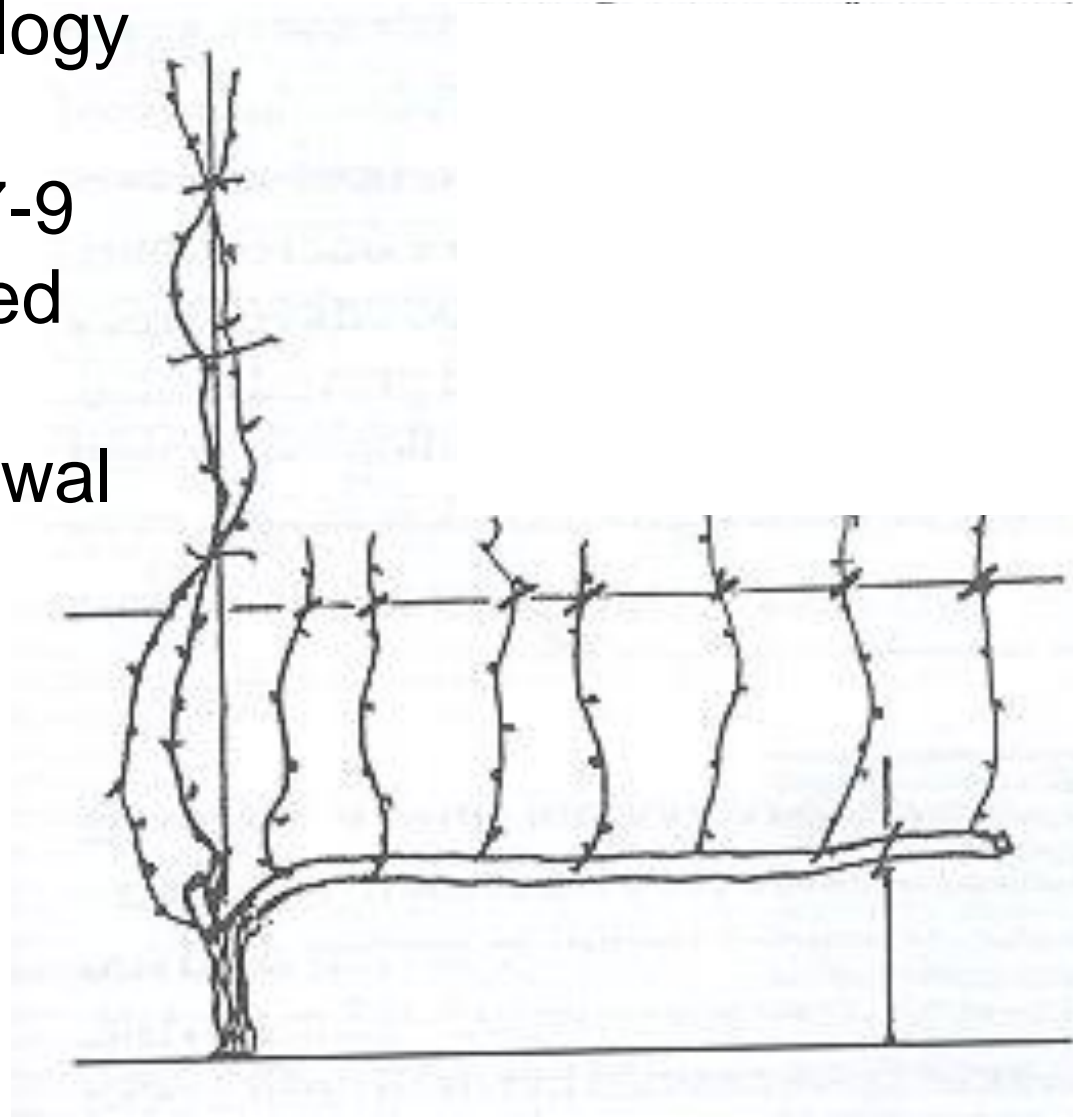
- In downward direction, remove all unnecessary shoots on the old plant wood
- Treat all major wounds with a tree wax or latex colour





## Guyot pruning system

- Basic technique in French wine technology
- Vine is low, 0.25 m
- At the top: 1 cane, 7-9 buds, horizontally tied to a wire; below the cane there is 1 renewal spur with 2 buds







- Mechanized pruning
- 1. Preliminary pruning
  - Pair of vertical pruning rotary discs (discs are lead onto the vine espaliers)
  - Vine shoots are cut into blocks
  - Saves time compared to conventional pruning
  - No need to pull the cut vine shoots and crush it later



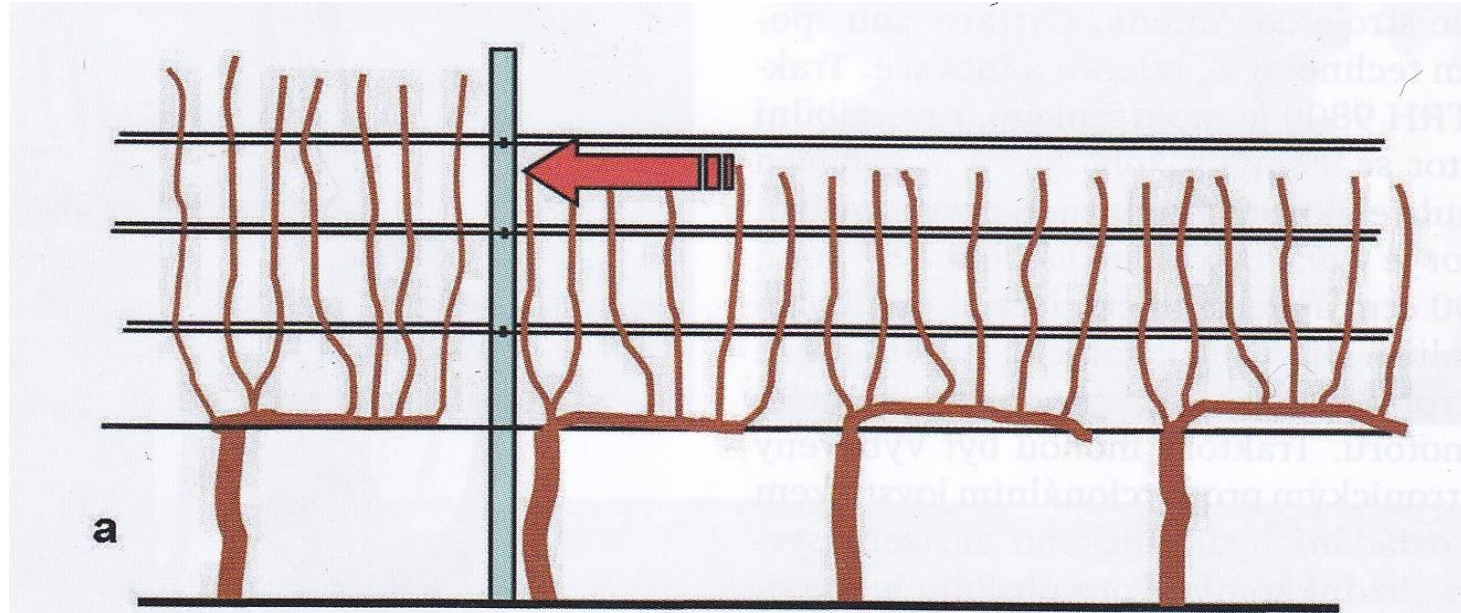
## Principle:

- Removal of all shoots at the designated height (cuts are 5-12 cm long)
- Cut pieces fall freely into the interrows (shoots may be collected and utilized for energy)

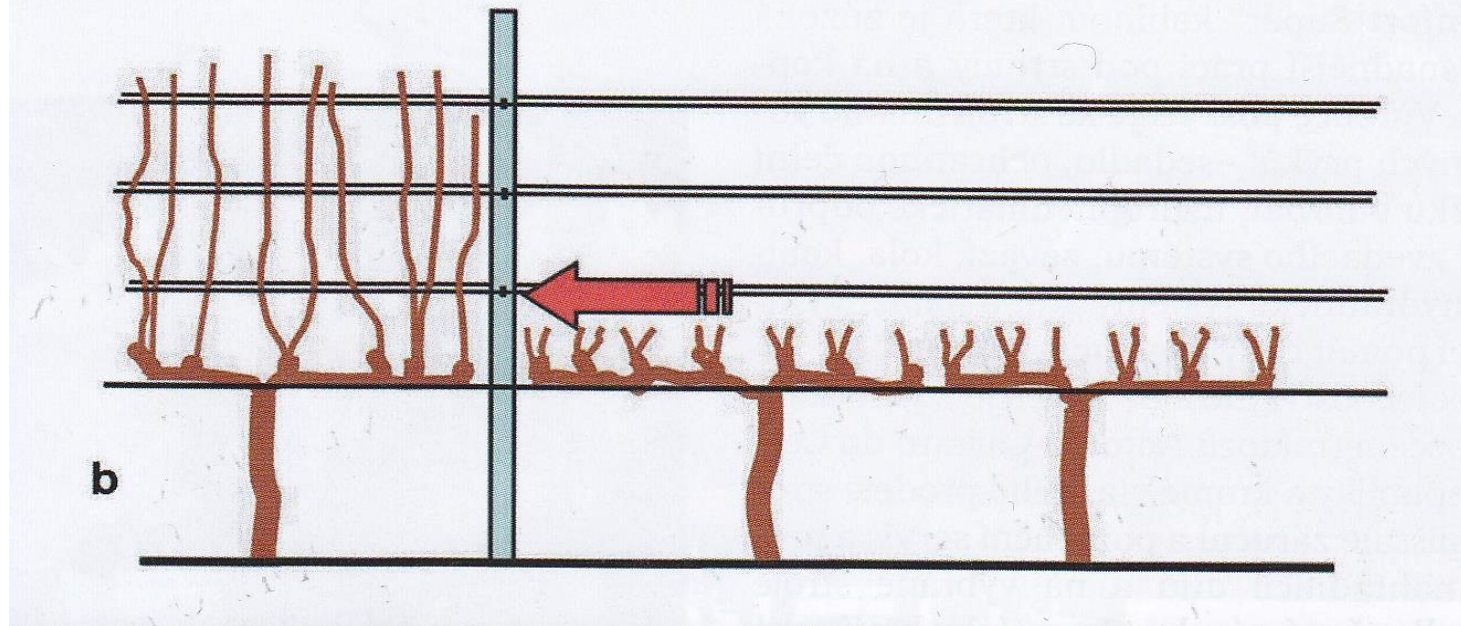


# Principle of mechanized preliminary pruning

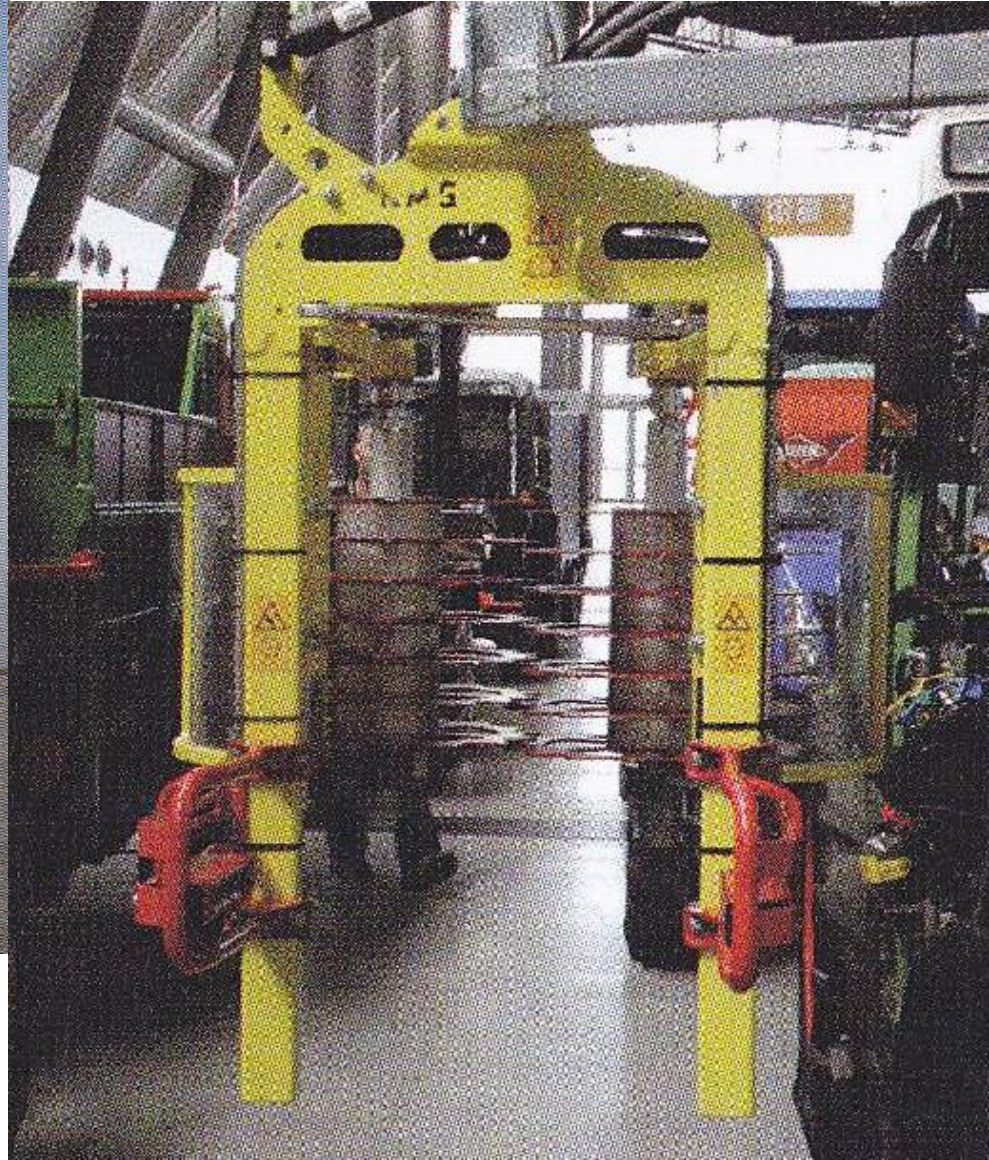
a – cane pruning



b – spur pruning



Machines are designed for tractors, and are positioned either upfront or on the sides



- System performance: 1.5-2 hours per 1 ha (CZK 1,400 per ha)
- Less time and money consuming pruning
- 30 % savings in cane pruning
- 70 % savings in spur pruning (removal of 70-80 % of the vine)
- Benefits: Less physical work, no need to pull out vine shoots from the double wire supports
- Highest savings – varieties with high amount of tendrils and vigorous growth: Sauvignon, Gewurztraminer, Neronet, St. Laurent, etc.



- Systems may work at a speed of 5-8 km/h
- Machine prices range from EUR 3,500-16,000 (CZK 88,000-400,000)
  
- 2. Manual pruning - finishing
  - Mechanized preliminary vine pruning is followed with a standard manual pruning (hand shears or electrical shears)

# GRAPEVINE TRAINING

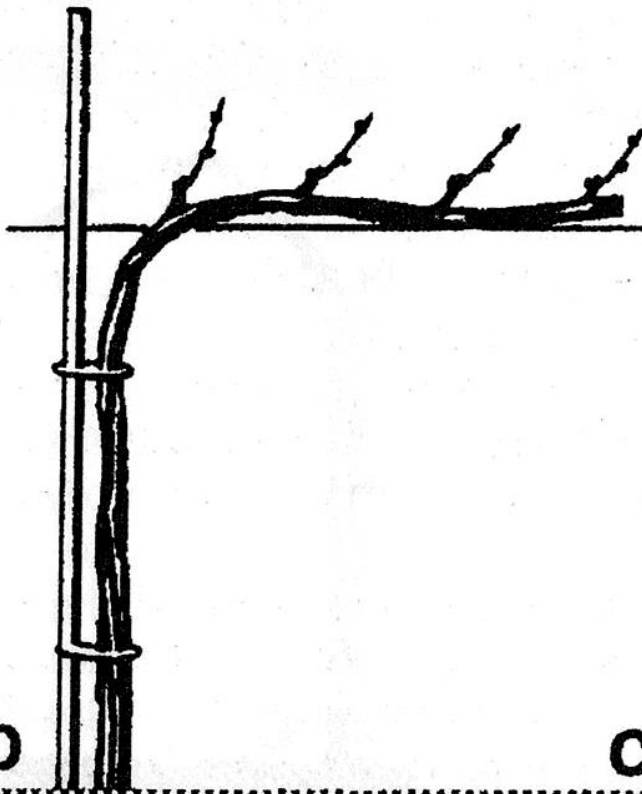
- Trainings refers to shaping of the old plant wood and its fertile vine shoots so that the vine has a desired form and size
- Particular training shapes must ensure maximum sun penetration – optimum annual shoot positioning
- Trunk height defines type of training:
- Low training – Max. 0,4 m (1900-1950)
- Medium training – 0.7 m
- High training - Above 0.8 m (max. 2 m)

Training = arrangement of aboveground plant parts

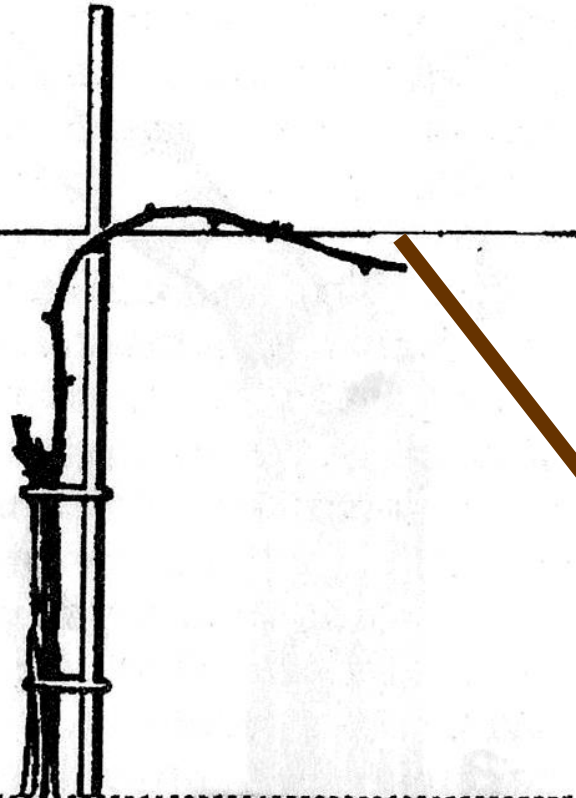
a) Head-pruned training system



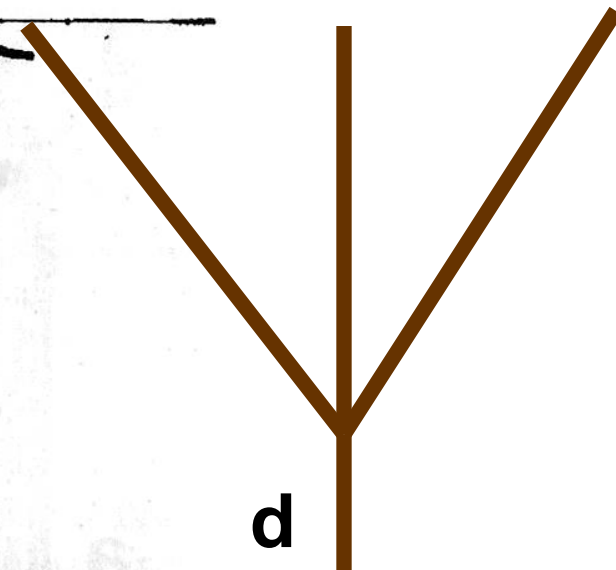
b) Spur-pruned training system



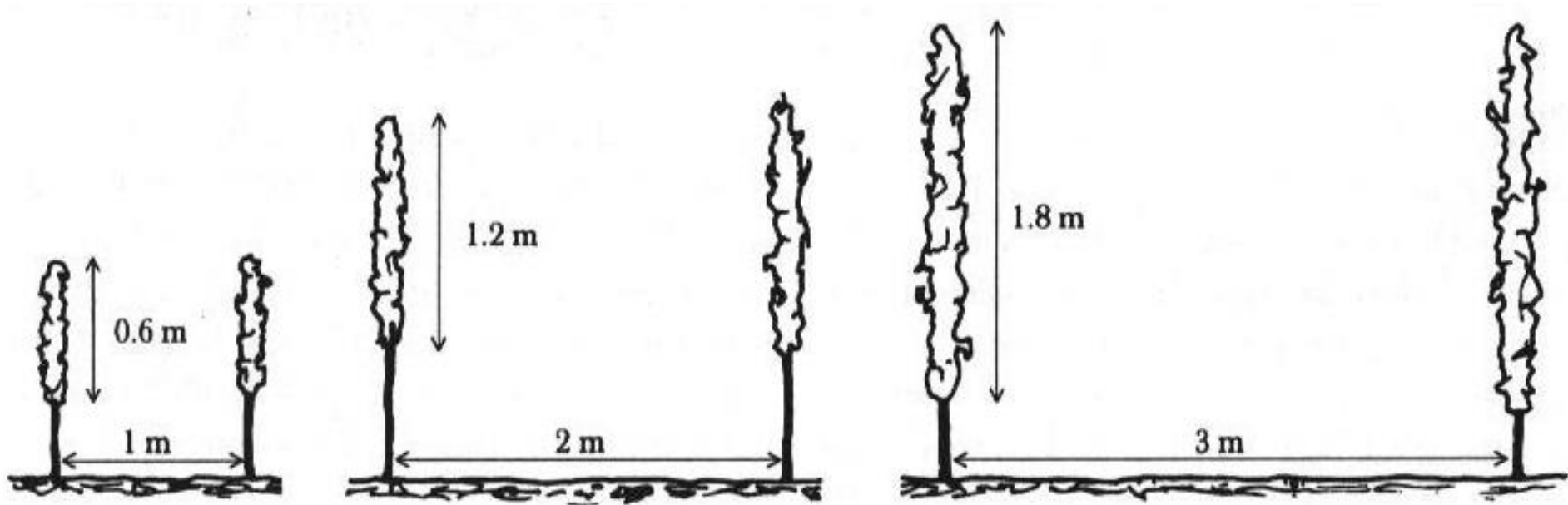
c) Cane-pruned training system



d) Fan pruning (palmette)



## Espalier height and plant spacing

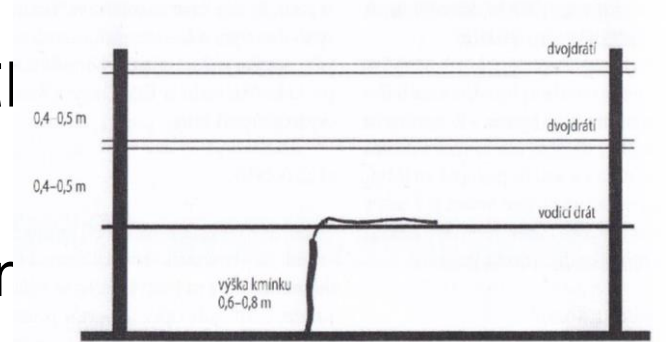


## Medium training

- Most common training in the Czech Rep. (small-scale winemakers as well as commercial producers)
- Trunk height: 0.6 m (blue varieties) – 0.8 m (white varieties)
- Spacing: 1.5-2.5 x 1.0-1.2 m
- 4,500-5,500 vines per 1 ha
- Support – trellis system
- Good height – allows for more convenient manual treatment of the vines
- The higher the trunk, the later the bud break and flowering and the slower the grapes ripe
- Risk of grape rot is decreased
- Optimum use of biological potential of the vine

# The so called Rhine-Hessen training

- Cane-pruned training
- Most common medium-height training



- After planting
- Shorten the seedling (rootstock stem) to 2 buds, cover with soil to prevent bud drying out / waxing
- Tie the annual shoots to a wire
- Aim: Cultivate a good-quality trunk without cutting wounds

