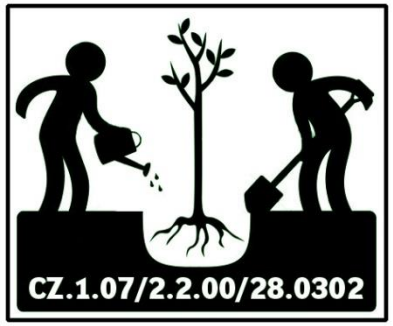
INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ



Inovace studijních programů AF a ZF MENDELU
směřující k vytvoření mezioborové integrace
CZ.1.07/2.2.00/28.0302

Tato prezentace je spolufinancovaná z Evropského sociálního fondu a státního rozpočtu České republiky

Fruit-bearing vegetables

Tomatoes *Lycopersicon esculentum*

- Origin: South America (Peru)
- They came to Europe in 15th–16th century
- Bigger expansion in 19th century, in CR after World War II
- In the last 10 years

Increase in the world consumption by 36%

Increase in the consumption of CR by 50%

- Share on production:

–Europe and North America 10%

–South America 30%

–Asia, Africa 30%

–Australia 30%

- Worldwide consumption is 16 kg per person and year
- Required consumption is 16.5 kg per person and year
- Consumption in CR is 9.9 kg per person and year

  Out of which: 7.5 kg fresh and 2.4 kg purees, ketchups
- Poland 9 kg per person and year
- USA 36 kg, but fresh only 12 kg (no motivation to increase the share: ketchups, purees)
- Yield:

– CR 33 $t.ha^{-1}$

– Austria 55 $t.ha^{-1}$ (total only about 80 ha)

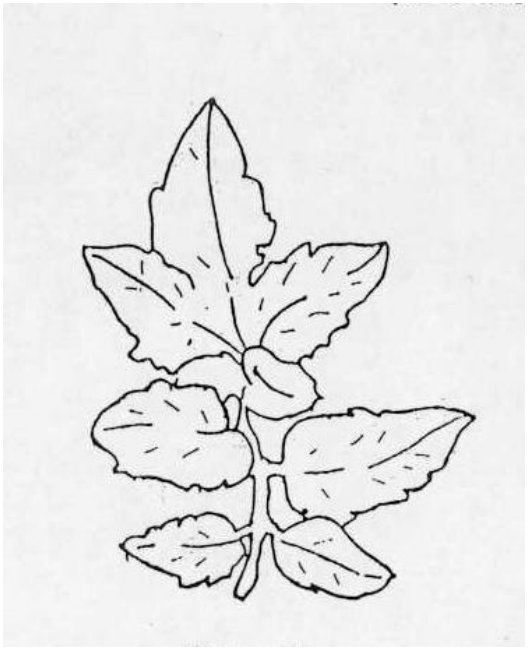
– Hungary 35 $t.ha^{-1}$

– Attainable: 60–80 $t.ha^{-1}$ (excellent even 100 $t.ha^{-1}$)

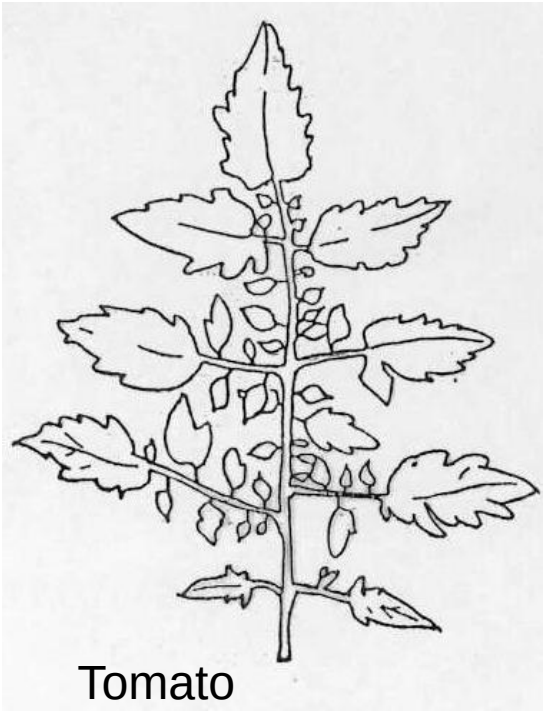
Perspective:

- Min. yield 35 $t.ha^{-1}$ (attainable: 80 $t.ha^{-1}$)
- Reduction of labour and transport costs
- Size sorting of fruits and uniformity of table tomatoes
- Mono-layer packing into crates
- Increase in consumption of fresh tomatoes
- Protection of domestic production from 15 August until 15 October

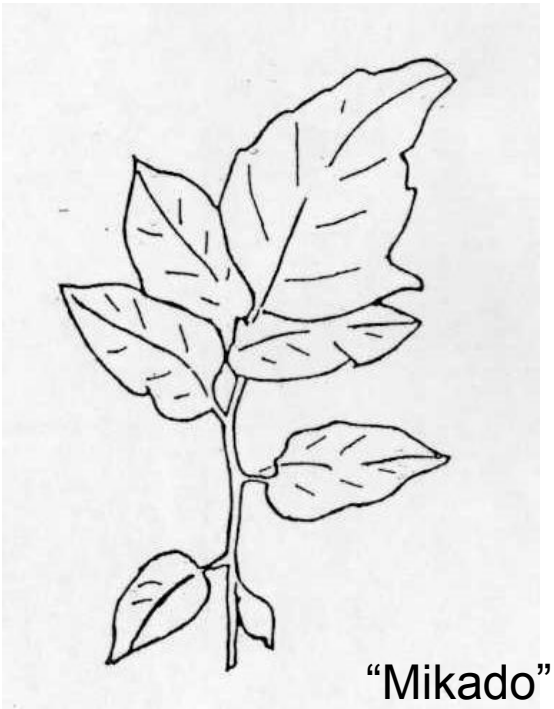
Leaf



Type “imun” (variety)



Tomato



“Mikado”

Trichomes limit harmful evaporation

Inflorescence

Fruit: berry

Nutritional values of tomato:

- Dry matter 5-6.3 %
- Fibre 1.5 %
- Protein 1.1 %
- Carbohydrates 4.6 %
- Ashes 0.6 %

- Dietary minerals ($mg.kg^{-1}$):

Ca	260 mg	K	2,970 mg
Fe	**11.8 mg**	Zn	2.2 mg
Mn	1.4 mg	S	188 mg
Cu	0.1 mg		

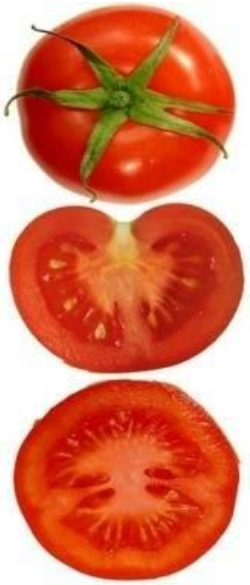
- Vitamins (mg .1000 g^{-1}):

A	3.59	B_1	0.92
C	224	B_2	0.76
E	12.2	B_6	1.16
PP	5.3		

- Toxic solanine in immature green fruits is dangerous in quantities of more than 5 kg eaten at once
- A lot of organic acids: malic acid, citric acid, oxalic acid, formic acid, succinic acid, lactic acid
  - Support blood circulation, kidney function, juice cleans and softens the skin, reduces acne and firms the skin (over-mature tomatoes)

Botanical characteristics of tomato

- Fruit – multi-section berry



Red colour means - more of lycopene (pigment)

Orange, yellow – more of carotene

Requirements

- Optimal temperature: above 20°C
- Growth stops at temperatures below 10°C
- Failure to bloom at temperatures below 15°C
- Pollen does not germinate at 13°C
- Night temperature below 10°C for 2 hours – loss of flower buds
- Min. temperature during germination is 9°C, optimal 22-25°C

- Cracking of fruits – uneven irrigation, influence of variety

Cropping practices

- Height of plant
  - climbing (indeterminate)
    - Up to 2 m for field cultures
    - 12 m in greenhouses (grown for 10 months)
    - Exclusively from pre-grown seedlings
  - Bush (determinate)
    - Up to 0.5 m
    - In order to prolong harvest, half of production of bush tomatoes is usually grown from pre-grown seedlings and the other half from direct sowing

• Heavy feeder and medium feeder; less demanding on irrigation than cucumbers and bell peppers, deeper roots

• Sowing on 10 March for pre-grown seedlings

Germinates in 5-8 days at 20–25°C

Germinates in 14 days at 13–14°C

• Planting after 15 May

• Direct sowing: 15–20 April, 15–20mm depth, 12°C soil temperature, accurate sowing, weight of thousand seeds (HTS): 2.5–3.5 g

• Spacing:

Climbing tomatoes from pre-grown seedlings: 0.8 x 0.8 m up to 1 x 1 m

Bush tomatoes: 0.6 x 0.3 m up to 0.6 x 0.4 m

• 15-30 mm of irrigation every 7–10 days, better not to spray – danger of fruit cracking

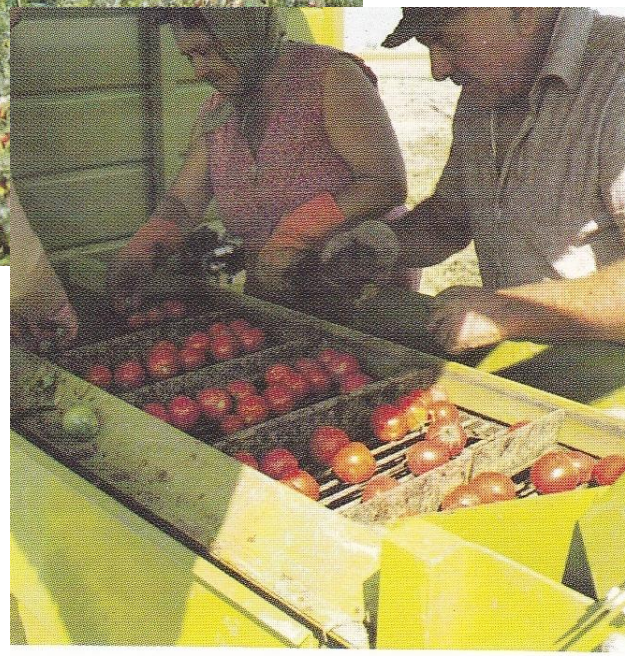
• Herbicides Sencor 0.3 $kg.ha^{-1}$ in 10 days after planting, Paarlan 1.5-2 $L.ha^{-1}$ before sowing or planting

- Harvest
  - Climbing tomatoes: manual picking
  - Bush tomatoes:
- Manual 2-3 pre-picking
- Mechanized destructive harvest
  - Spraying with Ethrel, Flordimex 2 $L.ha^{-1}$ 14 days before harvest; active substance: Etephon
  - Turn red within 14 days
  - Machine line Hungarian PBM 15, Italian Coopmes (self-propelled harvester), Pomac
  - Varieties for mechanized harvest last firm 10-18 days after harvest in stage of red maturity (Long live)

Coopmes machines: pull out plants and picks fruits


COOPMES


COOPMES



- Protection against potato blight
  - Preventive spraying – beginning of July - Kuprikol 0.7 %, Curzate 0.5 %
  - 2-3x, repeated after 14 days after harvest
  - Or first, spray with Acrobat 0.25 % (Protection period: 20 days), subsequently Kuprikol 0.7 %

Bell pepper *Capsicum annum* L.

- Origin: Mexico, imported to Europe by Columbus
- First to Spain, Portugal, Italy
- Later Balkans (18^{th}–19^{th} century)
- In CR: expansion after 1945-1950 (cooperatives)
- Recommended consumption is 6 $kg.person^{-1}.year^{-1}$
  - Reality is 5.1 $kg.person^{-1}.year^{-1}$
- Germinating seeds have yellow colour (dark brown, black seeds are not germinating – exclude with photodetectors!)
- 3-year germinating ability
- Sowing quota 0.5–0.6 $kg.ha^{-1}$ exclusively for pre-growing (germinate very slowly – in 3 weeks)

Nutritional values of bell pepper:

- Dry matter 7 %
- Fibre 1.9 %
- Protein 0.8 %
- Carbohydrates 2.6 %

- Dietary minerals ($mg.kg^{-1}$):

Ca	80 mg	K	1,700 mg
Fe	4 mg	Mg	100 mg
Zn	1.0 mg	P	190 mg
Mn	1.0 mg	S	210 mg

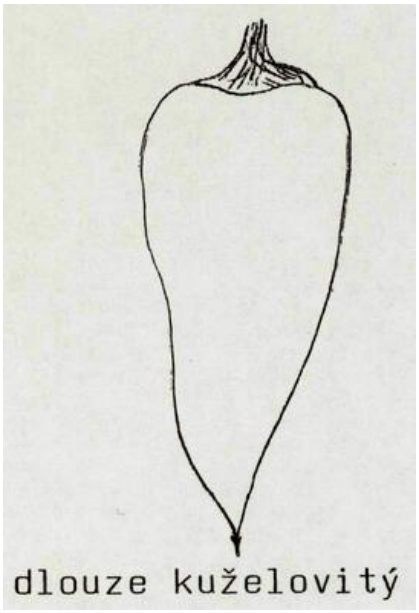
Bell pepper

- Vitamins (mg .1000 g^{-1}):

A	2.65	B_1	0.4
C	**1,200**	B_2	0.3
E	**8**	B_6	3.0

- Bioflavonoids (fight harmful cholesterol)
- Alkaloid capsaicin causes a sharp taste
  - Contained mainly in placenta, seeds and internal membranes

Bell pepper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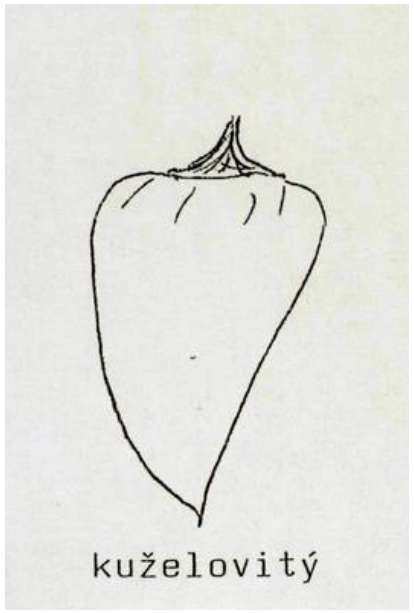
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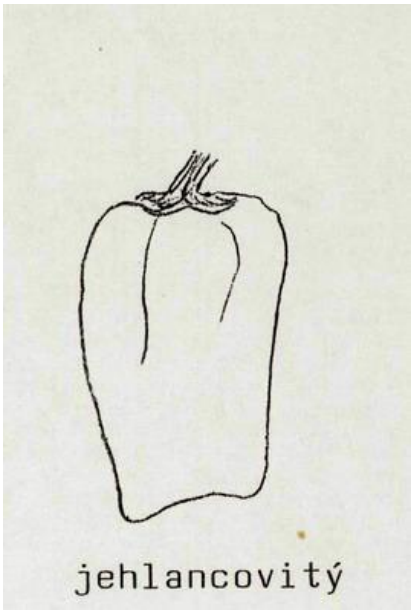
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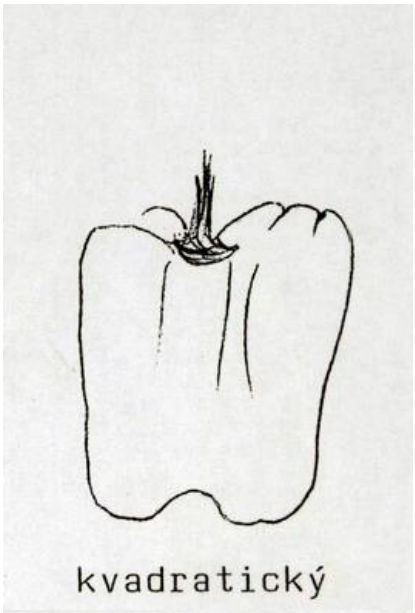
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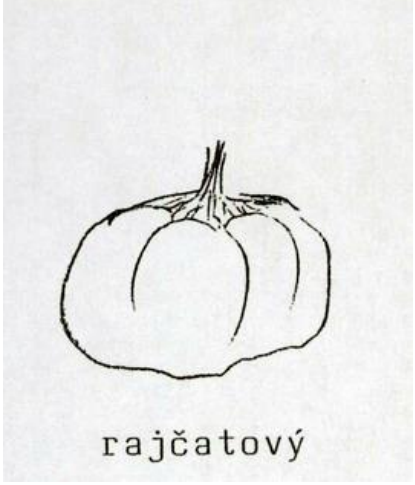
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Botanical characteristics

- Self-pollinating, fruit: berry
- Technical harvest maturity: colour white, yellow, green, red, orange, purple and brown
- Botanical maturity: orange or red
- Weight of a thousand of seeds (HTS): 6.0–7.3 g
- Germinates at 13°C
- Optimal for growth: 22–25°C, 18–20°C at night
- Freezes at -1°C

Cropping practice

- Soil
  - Light, calorific
  - pH 6-6.5
  - 60–80% of field water-holding capacity
- Air humidity: 60–80%
- Preceding crops
  - Appropriate: legumes, brassicas, root vegetable
  - Inappropriate: potatoes, cucumbers, tomatoes, corn (residues of herbicides), and lucerne (transmission of virus disease, root excretions – after 4 years)

- Heavy feeder: 40 t of organic matter.ha^{-1}
- Ideal: extra fertilization every week with Kristalon in watering (1 measuring cup per 10 L of water)
- Sensitive to chloride forms of fertilizers (all fruit-bearing vegetables)
- Per 100m^2: 0.2–0.3 kg of P_20_5, 0.7–0.9 kg of K_2O, 0.1–0.15 kg of MgO, 0.3–0.4 kg of N ammonium sulphate
- If yield reaches 20 t.ha^{-1}, bell peppers take:
  - 60-100 kg of N
  - 40 kg of P_2O_5
  - 120 kg of K_20
  - 10-15 kg of MgO

- Pre-growing always from seedlings (!)
- Sowing for pre-growing of seedlings from 20 January till 20 February
- Temperature for production of seedlings: 18–25°C
- Bell pepper has no natural protection against harmful evaporation (trichomes at tomatoes)
- Planting on permanent stands from 15 May till 30 May
  - Outdoor: Planting of 2 plants at 1 place
  - Into greenhouse, plastic greenhouse: always 1 plant only (2 plants cause uprooting and thicken the whole stand)

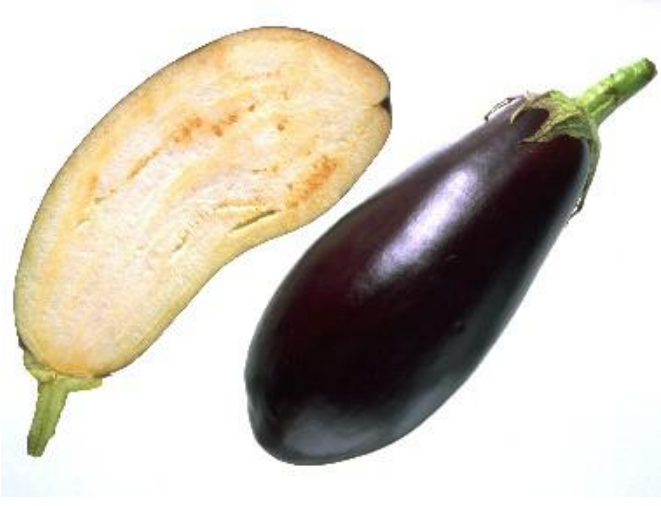
- Plant with water; pour water into holes, plant into mud and cover up with dry soil
- Spacing: 40 x 40, 50 x 30, 60 x 30 (80,000-90,000 pcs.ha^{-1})

- Irrigation is necessary throughout the whole period of vegetation in short intervals, min. once a week (8-10 irrigation doses)
- Bell pepper requires enough of ground air, soil must be loosened (supply of air for roots), never place plants below foil
- In low light (less than 7 hours), the plants will not bloom
- In CR: early varieties

- Yield CR (300 ha) 20 $t.ha^{-1}$
- Excellent yield with irrigation: 60–70 $t.ha^{-1}$

Eggplant (aubergine) *Solanum melongene* L.

- Origin: Far East, in Europe since 14th century
- Most grown in China, Japan, India
- More demanding on heat than bell peppers
  - Growing of eggplants in CR outdoor is inappropriate
- Very prone to Colorado potato beetle
- Cannot be consumed raw due to content of solanine and bitter substances, only after heat treatment
- Colour of fruit – berry is a varietal feature (purple – early and late, yellow - late, white - late)



Nutritional value of eggplant:

- Dry matter 6.5 %
- Fibre 1.3 %
- Carbohydrates 8.0 %
- Lipids 0.3 %

- Low in vitamins (mg .1000 g^{-1}):

A	0.3	C	50
B_6	0.8	E	0.3

- High content of pectins
  - Reduce blood pressure
  - Bind heavy metals
  - Reduce level of harmful cholesterol in blood
- Eggplants have higher share of P (mineral substance) than tomatoes and bell peppers
- Over-mature fruits are spicy, strongly bitter

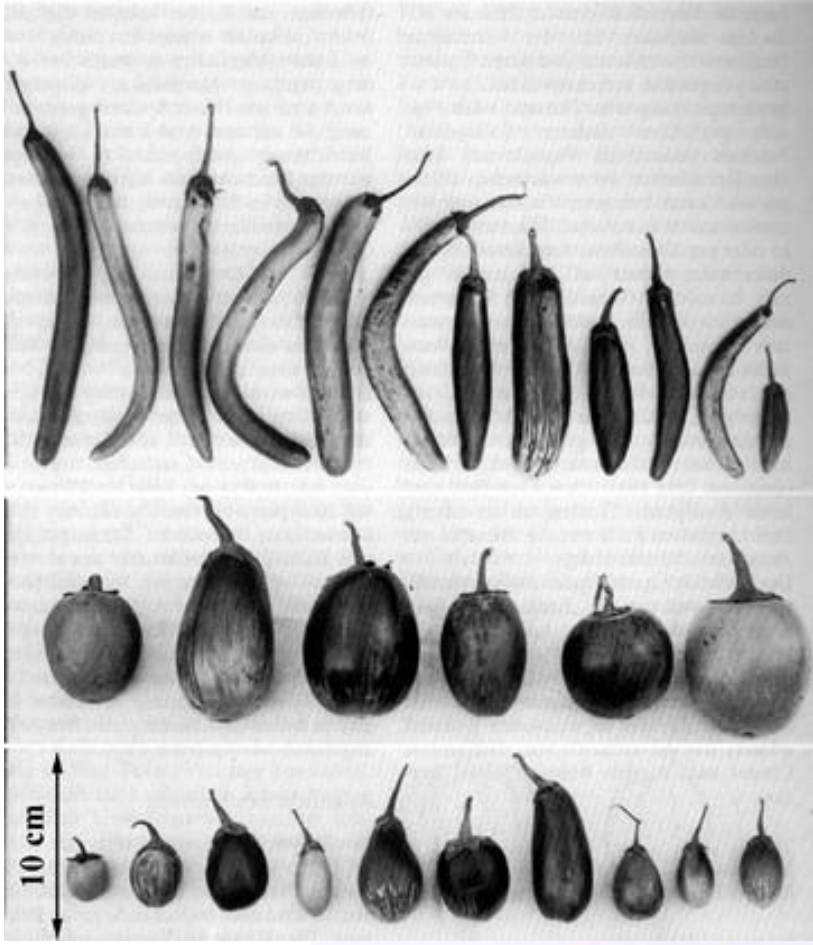
Botanical characteristics

- Annual plant
- Root system similar to tomato – stronger than bell pepper
- Stem is straight, bare, branched, 0.4-1m high, lignifies on base
- Leaf is egg-shaped to oval, simple, margin is entire
- Blooms are individual, petals are bluish to purple

Leaf

Bloom

- Fruit – berry
  - Egg-shaped, cylindrical elongated or spherical
  - Peel is dark purple, yellow, white or orange
  - Pulp is greenish, slightly spongy
- Seeds are light brown to pink, flat, smooth
- HTS 3.6–4.4 g




ZeSemen

Cropping practice

- Pre-grown seedlings:
  - Sowing: February, mini-seed tray T 96
  - Planting after 15 May
- Spacing: 0.4 x 0.4, 0.5 x 0.5
- Cover with non-woven fabric 4–6 weeks after planting till the time of blooming

Cucumber *Cucumis sativus* L.

- Originating from India and Africa
- Before 4,000 years in Egypt
- Brought by Slavs to Europe at the end of Middle Ages
- For consumption - alkaline nature
- Has the highest content of water of all vegetables + lowest energy content
- Annual plant with creeping, angular stalk, up to 4 m high
- Root system is shallow, requires lot of air (organic matter)

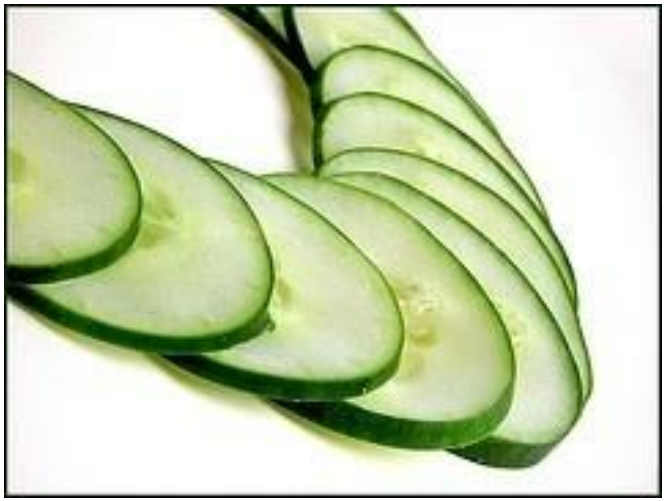
- Pulpy fruit: three- to five-capsule berry
- Surface
  - Smooth – greenhouse cucumbers
  - Gentle or rough spines

Cucumbers with dense spines have worse taste

Cucumbers with sparse spines have better taste

Cucumber

- Bitterness of the fruit:
  - Glycoside - bryonin, bryonidin
  - In hot, dry weather
  - Considerable temperature fluctuations between day and night



- Seed
  - Germinating ability: up to 6 years
  - HTS 20-30 g
- High requirements on heat and higher air humidity
- Optimal temperature:
  - Air: 22-30°C
  - Ground: 21-24°C

- Varieties
  - Gherkins
  - Cucumbers

➢ Grow only hybrid F1 varieties:
  - Short internodes: 20-25 cm
  - 3-5 female blooms per one node
  - Substantially higher labour productivity than with non-hybrids

➢ There are hybrids tolerant to downy mildew, and intolerant varieties for the same price

Cropping practice

- Heavy feeder: organic fertilizing 40 $t.ha^{-1}$
- Windless location or windbreaks, corn between rows
- Hates chlorine form of fertilizers - potassium sulphate
- Do not step on growing point: shock, and then the entire plant wilts

Gherkins

- Direct sowing: 0.7–1 kg.ha^{-1}: end of April till 15 June
- ”Seed cucumber on Mark’s name-day (25 April)“ – earliest sowing – risk of frosts! Best: 5-10 May
- Depth: 2-4 cm
- Spacing: 120-150 x 20-25 cm

Harvest of gherkins

- From beginning of July to mid-September
- Manually, harvesting platforms, harvested in a lying position, 300 $m.hod^{-1}$
- Gherkins:
  - Minimal 12 harvests – twice a week = 6 weeks
  - Optimally 8-12 weeks (20 harvests)
- Requirement of 1,600-1,800 hours of manual harvest per hectare
- Yield: 25-30 t
- Sorting according to diameter and length

A. Up to 25 mm diameter = 30–50 mm length

B. 26-30 mm = 51–70 mm

C. 31-38 mm = 71–90 mm

D. 39-50 mm = 91–120 mm

E. above 50 mm = above 120 mm

Salad cucumbers

- Most often direct sowing 0.7–1 kg.ha^{-1}:
  - End of April – end of May: field cucumbers
- Pre-growing of seedlings
  - For greenhouse growing
  - Seed trays with bigger cells
  - Pre-grown for 12-16 days – cotyledons, max. 1-2 true leaves
  - Planting of older seedlings = slower growth
  - Plants are sensitive – careful planting
- Spacing: 120-150 x 20-30 cm

Harvest of salad cucumbers

- Manual
- Once every 7-10 days
- Min. weight of fruit: 180 g
- Yield: 40–50 t

“Vertico” – growing on structures

- Advantages:
  - Faster and easier harvesting
  - Better quality, clean fruits
  - Lower infestation with downy mildew of cucumbers
- Disadvantages:
  - Costs on building of structure
  - Easily damaged by wind
  - More manual work (implementation, train plants, build construction)

Forcing of culture, low tunnels (only for cucumbers)

- Advantages:
  - Earlier onset of harvest
- Disadvantages:
  - Worse quality of chemical protection of culture
  - Higher labour intensity
  - Higher cost per unit of production
  - Growing point cannot touch foil – shock and death

Late sowing – from end of May until 15 June

- Advantages:
  - Better health condition
  - Easier chemical protection – closed stand of 4-6 leaves, easier to spray fully
  - Higher yields in second half of cucumber season (implementation value per kg); part of early sown stands have already wilted
- Disadvantages:
  - Lower yield per hectare
  - Shorter vegetation period

Pumpkin *Cucurbita pepo* L.

- Origin: America
- Form of bush pumpkin

- Forms of pumpkin:
  - Ssp. Giromontia — zucchinis
  - Ssp. Patissonia — pattypan squashes
  - Ssp. Olleifera — oil pumpkin (seeds without peel)

- Excellent storability

Pumpkin (*Cucurbita pepo* L.)

Cucurbitaceae (Gourd family)

- ssp. giromontia – zucchinis

- ssp. patisonia – pattypan squashes

- ssp. oleifera – oil pumpkin

- ssp. microcarpina - ornamental

Nutritional value of pumpkin:

- **Dry matter** **7-13 %**
- Fibre 16-2.0 %
- Protein 0.8-1.6 %
- Carbohydrates 2-8 %

- Dietary minerals (mg.kg^{-1}):

  Ca 230 mg

  Fe 8-15 mg

  Mg 100-200 mg

  P 300-600 mg

  K 1,400-3,500 mg

- Vitamin (mg .1,000 g^{-1}):

  C 100-160

Zucchinis

- Replace cucumbers, zucchini stands resist downy mildew of cucumbers longer than cucumbers
- Well timed harvest – length up to 20 cm and weight max. 500 g (thin peel, undeveloped seeds, buttery pulp)
- If we let a single fruit mature into botanical maturity, the plant will not develop other fruits, as if it “has done its share”

Pattypan squashes

- 2 sizes are harvested:
  - Size 3-5 cm: peel is light green and soft; whole pattypan squashes are preserved in sweet and sour pickle with oil
  - Diameter of fruit 15 cm and more: white peel is firm; fruits are preserved as cubes in sweet and sour pickle with oil, can be used as vegetable schnitzels, storability is 3-4 months

Oil pumpkin

- The fruits are matured into a botanical maturity
- Only seeds without peel of grey-green colour are harvested
  - Used like nuts
  - Source of zinc in human diet
- Scooped out pumpkins are left on the field - just for seeds

Cropping practice

- Heavy feeder, organically fertilized
- Direct sowing in May
- Spacing 1.5 x 0.8-1 m
- Harvest of zucchinis and pattypan squashes begins 60 days after sowing
- Weight of market zucchinis is 50-450 g, length 70-300 mm
- Yield: 30–60 $t.ha^{-1}$

Winter squash *Cucurbita maxima* L.

- Creeping stem, excellent storability
- Weight of fruit: 20–50 kg
- Only for leisure gardeners, there is no interest for high fruit weight

Seven-year melon (*Cucurbita ficifolia* L.)

Used like a rootstock for grafting of cucumbers, black seeds, non-consumable raw white pulp. For better water supply - unlike the cucumbers, pumpkin roots go deep. Do the notch with a razor blade on the side, 90% success.

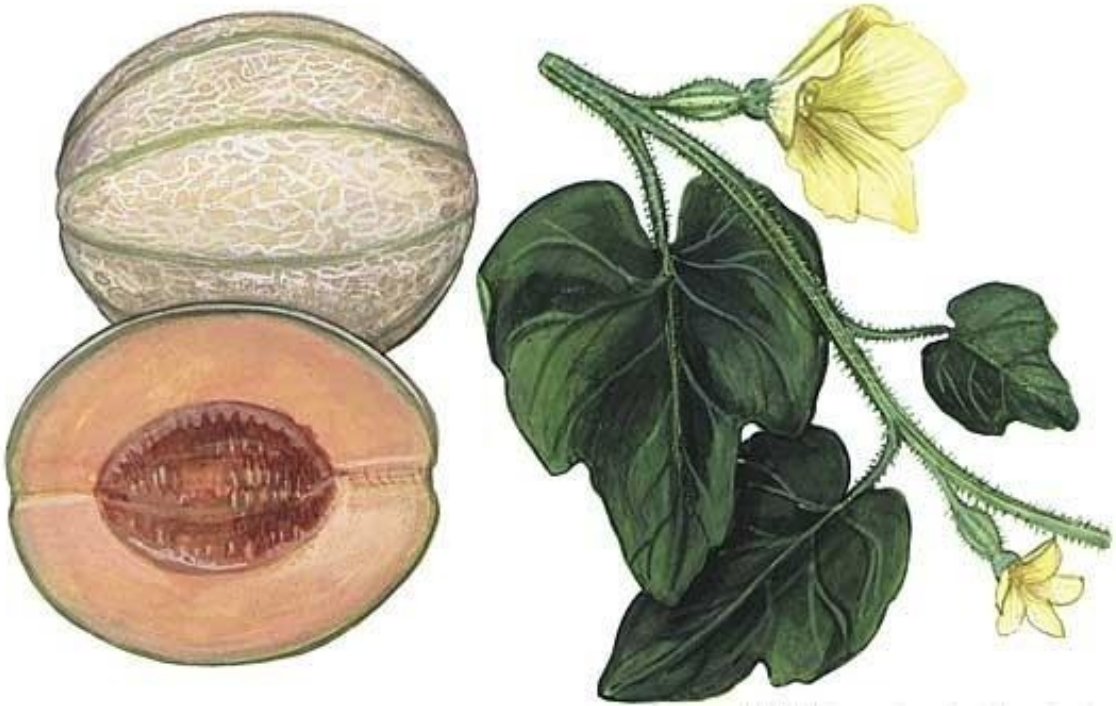
Musk pumpkin (*Cucurbita moschata* L.)

Decoration

Muskmelon *Cucumis melo*

- Origin: central Asia (Turkestan)
- Grown in China, Iran, Span, Japan
- Contains
  - 5–14% sugars
  - 0.25% citric acid
  - 30–50 mg% ascorbic acid
- Optimal temperature: 25°C
- Pre-grown seedlings at the beginning of April
  - Germinates at 14-16°C, optimal: 25–30°C
- Direct sowing at the end of April until the beginning of May
- Spacing: 1.2–1.5 x 0.4 m
- Mulching with foils, harvest 12–15 $t.ha^{-1}$
- Economically feasible growing: up to 100 m above sea level

- Colour of pulp is a varietal characteristic:
  - Yellow
  - Orange
  - Light green
- Seed is similar to a cucumber seed but is intensely coloured with a touch of orange
- Leaf is similar to a leaf of cucumber, margin is entire



Watermelon *Citrulus vulgaris*

- Origin: South Africa
- Grown in Turkey, China, Japan and Egypt
- Contains
  - 3-8 % sugars (per 100g)
  - 0.17 % citric acid
  - 10-20 mg% ascorbic acid
- Shape of fruit is spherical, elliptical or flat-spherical
- Colour of peel is dark/light green or streaked
- Colour of pulp is pink, rich red
- Colour of seeds is a varietal characteristic – white, brown red, yellow, black
- Leaf is very rugged, carved

- Watermelon likes lighter humus soils; optimal temperature: 25-30°C
- Pre-grow seedlings at the beginning of April
- Direct sowing at the end of April to the beginning of May
- Spacing: 1.5–1 m, 1.5 x 0.8 m
- Mulching between rows

- Harvest maturity: shrunken peduncle, shiny peel and light-yellow spots at the place where it touches the ground (immature watermelon has light-green or white spots), yield: 20–35 $t.ha^{-1}$

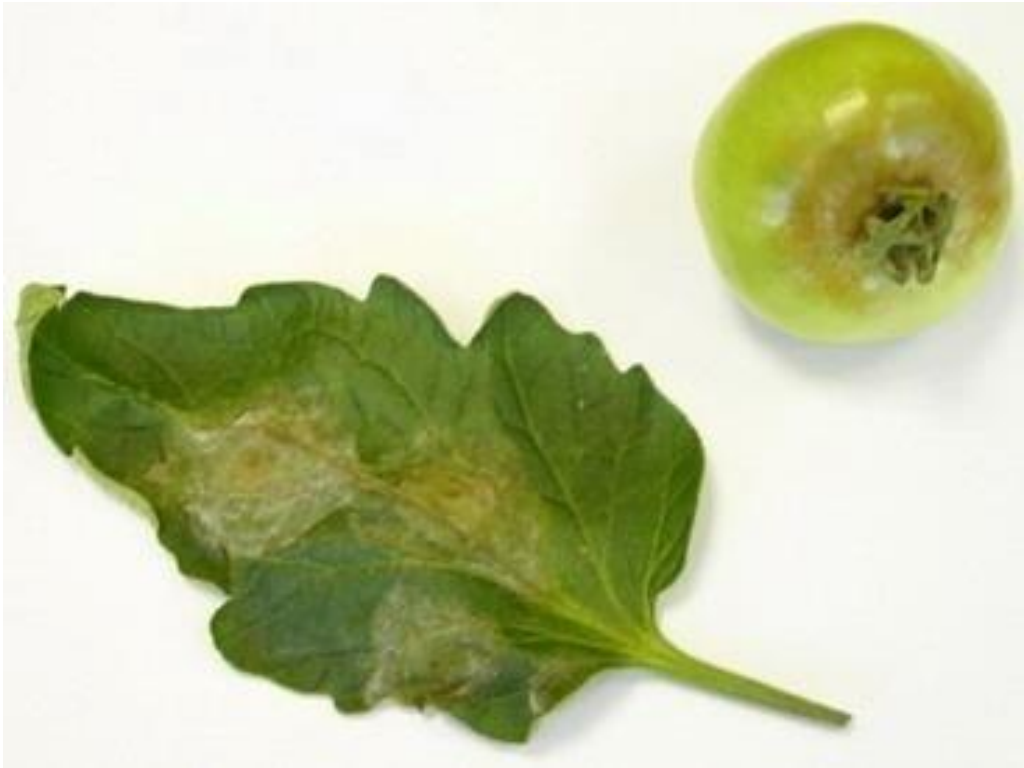
Watermelon

Watermelon

Diseases and pests of fruit-bearing vegetables

Tomato (potato) blight - Phytophthora infestans

- At first, grey green watery spots show up on older leaves, later they turn grey brown and subsequently black
- Infection spreads on fruits from the calyx, spots are grey green to brown, wrinkled on surface; pulp of fruit below the spot is hardened
- Sharply defined, stalk-hugging brown spots, are formed on stalk



- Fungus overwinters in infected potato tubers
- From mid-June, sporangia are carried by wind for long distances from primary sources in the potato stands into the stands of tomatoes - secondary infection occurs after min. 4-hour wetting
- Protection: keep the stands dry, water with drainage systems, prevent drizzle on leaves, give priority to resistant varieties, and apply fungicides

Acrobat 0.25% protection period is 21 days

Dithane 0.2% 21

Champion 0.3-0.4% 7

Kuprikol 0.4-0.7% 7

Ridomil Gold 0.25% 3

Bravo 0.25% 7

Downy mildew of cucumbers - Pseudoperonospora cubensis

- Oil spills on the leaf, visible against the light – too late to spray (this will only slow the progress)
- Be aware of signals – preventive spraying in first decade of July – when mould is in south Slovakia and Hungary (1 to 5 July)
- Preventive treatment against downy mildew of cucumbers according to signals; Acrobat 0.3% has 21-day protection period, Mikal 0.3%: 8-day protection period, Alliete 0.2% 3-day protection period, others do not work!

Early blight - Alternaria solani

- Concentric, brown-yellow spots with yellow margin appear on old leaves
- Occasionally, there are brown zones on stalk or sharply defined, slightly sunken black spots on fruits in the area of calyx
- In case of higher temperatures and higher air moisture (conidia are spread by wind and rain)
- Protection is the same as against potato blight

Septoria leaf spot - Septoria lycopersici

- On basal leaves: up to 5 mm large, rounded, watery spots
- In the centre of spots, there are fruiting bodies – black spots
- Fruits are not infected, stalks only rarely
- Does not cause significant economic losses
- Fungus overwinters on residues in soil
- Disease is spread by conidia, spread by the wind and rain
- Fungicidal treatment is the same as treatment against potato blight and early blight

COLORADO POTATO BEETLE - Leptinotarsa decemlineata

- Regent 0.03%
- Decis 0.03%
- Novodor (biologic preparation)

APHIDS

- Actelic 0.15
- Dursban 0.2 %
- Pirimor 0.15 %
- Sumithion Super 0.1 %

BELL PEPPER – BLOSSOM END ROT

- Lack of calcium
- Slumping brown spots, aesthetic defect
  - Kalkosol
  - Wuxal Calcium