LESSON 1

INTRODUCTION INTO THE TOPIC

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CONTENT

- Introduction
- Legislation
- Specific legislative instructions
- Why grow food in organic quality
- Organic farming
- Place of vegetables in the system of ecological agriculture
- Community growing and family farms
- Test from Lesson 1

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INTRODUCTION

- **Project title:** Education for sustainable development of rural areas in Slovakia, Latvia, Germany, Sweden and Denmark

- **Part of the project:** Growing of food in organic quality. Communities and family farms

- **Authors of the training program:** Ján Šlinský, Jarmila Welterová

- **Education concept:**

  The training program will be implemented through a course lasting five weeks, including:

  4 weeks theory

  1 week practice

  In theory each week will be two lessons lasting 2x 45 min

- **Target group:** unemployed, landowners, interest groups

- **Evangelical Church of the Augsburg Confession in Slovakia, Bratislava 2017**

LEGISLATION

- Quality of nutrition significantly affects human health
- Nutrition trends in the world - growing of fruits and vegetables without the use of chemical agents
- Interest for the organic cultivation and legislative support in the society grows
- Sustainable system of cultivation, a balanced system of ecological, economic and social requirements

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SPECIFIC LEGISLATIVE INSTRUCTIONS

- **In Slovakia**
  - **Law no. 224/1988 Coll.** on organic farming and organic food production
  - **Law no. 421/2004 Coll.** so called. "Competence Act" - the issue of competence, a system of registration and penalties in Slovakia
  - marginally the **Act no. 152/1995 Coll.** and other regulations and legal guidelines
- **In Europe**
  - **Council Regulation (EEC) No 2092/91** on organic production of agricultural products
- **In individual countries**
  - specific **national legislation**

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WHY GROW FOOD IN ORGANIC QUALITY

- Healthier way of nutrition by population
- Bio-vegetables - the most demanded product - the widest range of requirements for growing
- Organic farming - integrated component of the sustainable agricultural development
- Family farms, community growing vegetables - social relations in the area

- Solution to the problem of high unemployment rates in rural parts of the country
- Healthy soil = healthy plants = healthy animals = healthy people = strong society

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ORGANIC FARMING

- Using of local resources and potential of the country = **elimination of imports**
- Using natural methods of fertilization and plant protection = **elimination of industrial fertilizers**
- Using of available scientific knowledge in plant protection = **elimination of chemistry**
- Using of natural predators against pests = **support of biodiversity**
- Organic farming - integrated component of **sustainable agriculture**

- Cultivation of soil in "small" = **eliminate the devastation of soil** by heavy machinery

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PLACE OF VEGETABLES IN THE SYSTEM OF ECOLOGICAL AGRICULTURE

- Term vegetables, from agronomic view, covers wide spectrum of cultivated plant species
- Growing vegetables is compared to other crop production **more demanding**
- Vegetables is **the most demanded organic product**, its surplus on the market is excluded
- Most important is the **attitude of each individual producer**, who will ensure that the rules to organic farming are adhered

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COMMUNITY GROWING AND FAMILY FARMS

- Land ownership (family farm) = **responsible attitude**
- Association of like-minded people in the community = **responsible attitude**
- Economic advantage of growing
- Technical feasibility
- Socially acceptable method of growing
- Important - **a consensus** of all stakeholders **on the basic principles**

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1. Which law defines conditions of organic farming in Slovakia?

a) Decree of Ministry of Agriculture of the Slovak Republic from October 1st 1999 no. 3259/1999

b) Act no. 421/2004 Coll., called "Competence Act"

c) Act no. 224/1988 Coll., on organic farming and organic food production

2. Who ensures control in organic farming in Slovakia?

a) Ministry of Agriculture of the Slovak Republic

b) Slovak Trade Inspection

c) Other authorized and certified institution

3. What is the difference between organic and sustainable agriculture?

a) They don´t have nothing in common with each other

b) Organic farming is perceived as an integrated component of sustainable agriculture

c) Sustainable agriculture is an integrated component of organic farming

4. In which regard is own organic vegetable better than vegetable accessible in shop?

a) It is effortless accessible in shops

b) It is tastier, with higher content of nutrients, provides better feeling based on own effort

c) It is cheaper, has higher content of chemicals and vitamins

5. What is the difference between family farm and community garden?

a) There is no difference between them

b) Difference is in the ownership of the land

c) Difference is in the ownership of the land and decision-making competencies

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LESSON 2

SOIL

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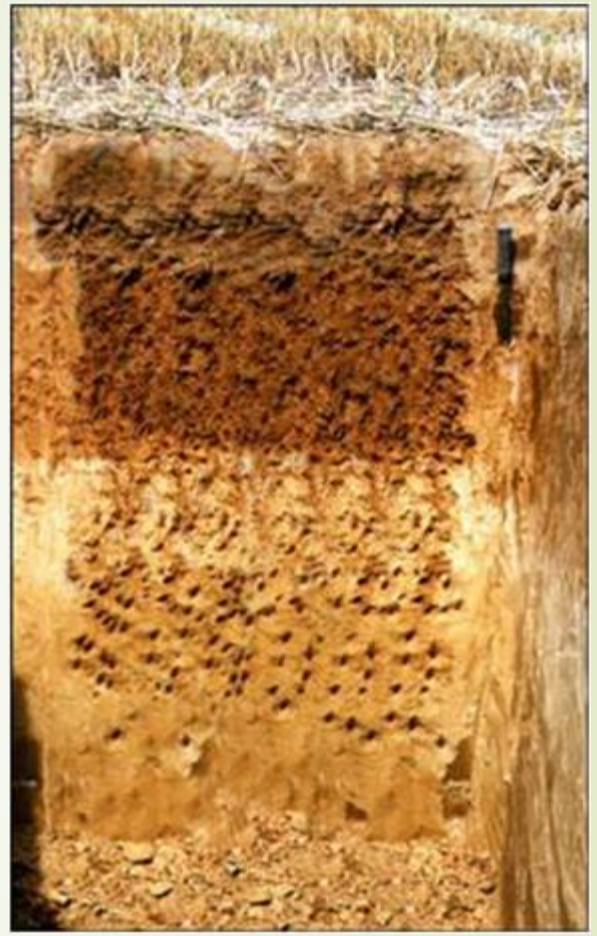
CONTENT



- Choice of location
- Type of land
- Soil types and their characteristics
- Requirements of vegetables
- Test from Lesson 2

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CHOICE OF LOCATION

Ideal conditions for growing vegetables

- Altitude locations under 350m above sea level
- Ideal soil for growing vegetables is light to medium, slightly humic, **humus content ca. 3-5%**
- Well permeable to water and air and has good water capillarity
- Sandy or loamy with good structure, **biologically active**

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CHOICE OF LOCATION

Ideal conditions for growing vegetables

- Appropriate **gradient of the land**
- Soil without **hazardous substances**, distance of at least 150m from busy roads
- Favourable light conditions - **sufficient sunlight**
- Location protected from drying by wind

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TYPE OF LAND

Ideal location does not exist!

- It is necessary to respect the country and its properties
- Types of grown vegetables must be adapted to area and climate conditions
- Influencing soil quality must be in line with **sustainability requirements**
- Soil cultivation must be done using natural methods

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TYPE OF LAND

Ideal location does not exist!

- Using if considerate cultivation methods, natural fertilization, planting of windbreaks
- Construction of thought-out systems of irrigation
- Planting species traditional in the area
- Gaining information about the area and the possibilities of growing

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SOIL TYPES

- LIGHT
- MEDIUM
- HEAVY

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SOIL TYPES

Light

- Sandy – more than 90% of the content are sand particles
- Loamy sand – 85 to 90% of the content are sand particles

This soil is light, easy to cultivate, is free draining, but nutrients are washed away quickly

- needed is delivery of nutrients, regular watering
- can be improved by adding clay particles for better water retention

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SOIL TYPES

Medium

- **Sandy loam** – content of clay is less than 20%
- **Loam** – contains small amount of sand particles and about 27% of clay particles
- **Silt loam** – contains 50 to 80% silt, rest is loam
- **Clay loam** – content of silt is 27 to 40%, rest is clay

Keeps long moisture and nutrients, but is hard to cultivate, stays wet and cold long time

- we deliver nutrients, loose the soil
- improve the structure of the addition of bio-materials

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SOIL TYPES

Heavy

- **Clay** – contains more than 75% of clay particles

Heavy, greasy, stays long wet, contains few nutrients, is very hard to cultivate

- not suitable for most vegetable species
- needs delivery of nutrients and regular loosening of topsoil
- water retention has to be done by drainage
- has to be treated by adding sand and of bio-materials

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SOIL TYPES

What kind of soil type it is?

Whether the land is light (sandy), medium heavy (loam) or rather heavy (loam clay), you find out when you pick up a little in the palm, mix with small amount of water and compress.

- If you manage to form a hard ball with a glossy surface or roller
  - it indicates an increased proportion of clay particles
  - although such soil retains water well, after heavy rain remains greasy and sticky
  - during the prolonged drought is compacted
  - Need to be enriched with sand and organic fertilizers
- If you press a soil sample after unfolding the palm it falls apart
  - it indicates a higher proportion of sand
  - loam - remains compact
  - clayey – clearly can be seen fingerprints
- If you fail to form the soil on pellet or roller or it takes too long
  - it indicates that the soil is sandy

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REQUIREMENTS OF VEGETABLES

Types of vegetables		Suitable soil type
Brassicas		soil lighter and more clayey, colder, nutrient-rich
Root vegetables		soil rich in humus, loose enough, lighter
Fruit vegetables		light, quickly warmed-soil with plenty of moisture
Onion vegetables		sandy soil with plenty of moisture, not sour
Green vegetables		sandy-loamy moderate rich of humus, not calcareous
Legumes		good humus content, soil can be neutral or slightly alkaline

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1. What are features of soil ideal for growing vegetables?

a) Light to medium, slightly humic, sandy or loamy with humus content 3-5% and neutral soil reaction (pH 6,5-7,3), well permeable to water and air and with good water capillarity

b) Heavy, waterlogged soil, full of stones

c) Sandy, light, easy to work with, dries and warms up quickly

2. Which kinds of soil do we know in dependence of a number of mineral particles?

a) Light, medium, heavy and neutral

b) Sandy, loamy sand, sandy loam, loam, silt loam, clay loam, clayey

c) Sandy, acidic, loamy, alkaline, clayey, neutral

3. What is optimal location for organic farming?

a) Location more than 350m above sea level, protected, light to medium soil, ground water at a depth of about one meter

b) Each location under 1350m above sea level after necessary treatment

c) Location under 350m above sea level, protected, with layer of topsoil from 0,4 to 0,6m, ground water at a depth of about one meter

4. What kinds of vegetables can be grown in acidic soil?

1. All kinds of vegetables without exception
2. Brassicas and root vegetables
3. Acidic soil is not suitable for any kind of vegetables with exception of leguminous plants, which tolerate slightly acidic reaction

5. What kinds of improvement of soil quality are suitable by organic farming?

a) Use of organic matter as natural fertilizers, liming with dolomitic limestone, green manure

b) Use of fertilizers, chemical sprays for combating weeds and pests

c) Nothing, nature can deal with it on its own

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LESSON 3

LAND CARE

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CONTENT

- Principles of land care
- Cultivation of land in ecological agriculture
- Basic cultivation of soil
- Cultivation of soil
- Cultivation of soil during vegetation
- No-till cropping
- No-till cropping – the method
- Test from Lesson 3

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PRINCIPLES OF LAND CARE

Healthy soil = optimal conditions for healthy plant growth

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good yields

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PRINCIPLES OF LAND CARE

The importance of non-cultivated areas for synergy effect

- Conditions for undisturbed life of "beneficial organisms"
- Cultivation of land in considerate and thought-out way
  - without compacting
  - without the use of chemical agents

- Active transformation of the land
  - planting of windbreaks, „edible forests"
  - drainage systems or irrigation systems, where it is needed

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CULTIVATION OF LAND IN ECOLOGICAL AGRICULTURE

Based on thorough knowledge of the land, interconnections in the environment and sufficient expert knowledge is necessary to

- Cultivate soil adequtely to its specific physical parameters
- Cultivate soil by favourable moisture conditions

The aim of land cultivation is

- Growing of high-quality vegetables in sufficient quantity
- Improvement of soil resistance against
  - heavy rainfall, leaching of nutrients
  - compression by vertical stress, creation of compacted soil layers

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BASIC CULTIVATION OF SOIL

Basic cultivation of soil is used for

- Loosening of compacted soil layers = better water and nutrients management
- Support of life of micro-organisms in the soil

Basic cultivation has to be performed once a year

- Loosening of the soil to the depth of 10-25 cm, without turning the soil (manual tools, e.g. pitchfork)
- Without the use of heavy machinery

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CULTIVATION OF SOIL

Cultivation of soil is used for

- Improving of soil structure
- Incorporation of crop residues and organic fertilizers (during tilling)
- Preparation of beds (to a depth of loosening up 10 to 15 cm) before sowing and planting seedlings
- Weed control (during the whole season)

Requirements for cultivation of soil

- Loosening in uniform depth without skipping places
- Loosening, stirring without overturning the soil
- Tools: rototillers and chisel plows, hoes, cultivators, pitchforks

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CULTIVATION OF SOIL DURING VEGETATION

Is used for

- The mechanical control of weeds
- Disintegration of soil dryness situations
- Aerating and loosening the soil surface layer

Cultivation of the soil should be done

- As often as for given vegetable species necessary
- On warm, sunny days, so that weeds are quickly dry
- As close to the row of crops as possible, but without damaging the roots
- With weeders, hoes or mechanical cultivators

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NO-TILL CROPPING

- Growing vegetables in the plots without the use of mechanical tillage
- Growing of mixed cultures - no need to crop rotation
- Excellent habitat for a number of useful insects, birds and other animals
- Soil is during one year proportionately biological revived
- Mulch should be kept by adding a new organic material (hay, straw, sawdust, etc.)

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NO-TILL CROPPING – THE METHOD

- Mow or roll entire surface, residua should be spread over the area
- Add nutrients (dolomitic lime, chicken manure, compost, other organic material)
- Add layer of organic mulch (cardboard, old wallpaper, newspaper, jute bags, felt and similar natural material, that gradually decomposes and contributes to plant nutrition)
- Thoroughly irrigate
- Apply at least 5 cm of compost on the top of the whole area
- Cover with at least 15 cm layer of dry plant material (straw, wood chips, sawdust ...)
- Plant the seedlings - push back mulch, put into a hole good compost soil, plant the seedling and pile up mulch back to the seedling

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1. What are biggest disadvantages of plowing in organic farming?

a) Plowing is loud and demanding on fuel consumption

b) Plow turns the soil upside down, what causes destruction of microorganisms and worsening of soil structure

c) Plowing doesn´t have disadvantages

2. What does mechanical improvement of soil mean?

a) Mechanical manuring

b) Eradication of weeds

c) Improvement of soil structure, incorporation of crop residua, adjustment of compacted soil

3. What is the main goal of soil cultivation before sowing and planting?

a) Aesthetic shape and colour of seedbeds

b) Weed control, cleaning of seedbeds

c) Securing of appropriate conditions for growing and protection of sown and planted seedlings

4. Main principles of cultivation with sweep cultivator are?

a) We cultivate shallow, by nice weather, as close to the row of crops as possible, each time when necessary

b) We cultivate shallow, only after the rain, once a year

c) Cultivation is not necessary

5. Assets of no–till farming system are?

a) We can re-use a lot of old carpets and newspapers

b) We improve microbial structure of soil and don´t need to agitate soil mechanically

c) We don´t need to care about compost

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LESSON 4

NUTRITION AND FERTILIZATION IN ECOLOGICAL FARMING

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CONTENT

- Nutrition and fertilization in ecological farming
- Nutrients – Macro elements
- Nutrients – Micro elements
- Compost
- Fast composting – compost in containers
- Lazy compost
- Vermicompost
- Green manure
- Test from Lesson 4

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NUTRITION AND FERTILIZATION IN ECOLOGICAL FARMING

- Ecological farming = more efficient use of natural resources
- All the nutrients that the plant has taken leach back to the soil
- Comprehensive approach aiming to ensure soil fertility through support of life in soil
- Soil filled with living organisms

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Good crop without additional fertilization with synthetic fertilizers

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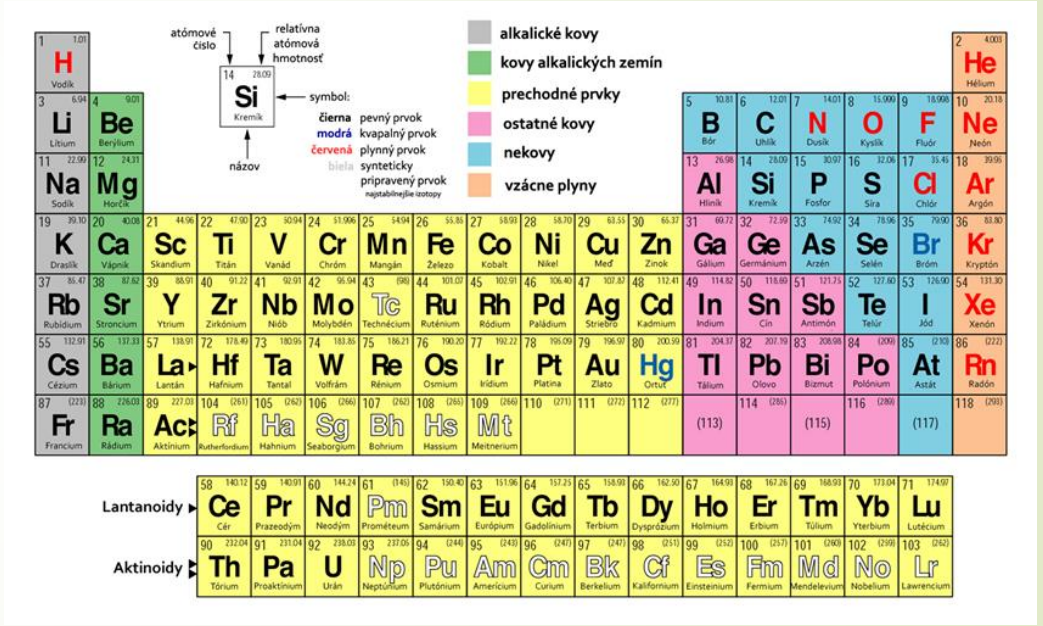
NUTRIENTS – MACRO ELEMENTS

Plants get nutrients from soil solution through roots by means of complex physiological process

- Biogenic macro elements:
  - **carbon, oxygen, hydrogen** → formation of each organic material
  - **Potassium** → affects metabolism of carbohydrates, protein synthesis, promotes accumulation of storage substances in the plant, and improves the maturation of plant
  - **Phosphorus, calcium, sulphur** → production of proteins
  - **Magnesium** → affects photosynthesis - part of the chlorophyll molecule
  - **Iron** → catalyser by chlorophyll production

- To macro-elements belong also
  - **Sodium, chloride**

The periodic table



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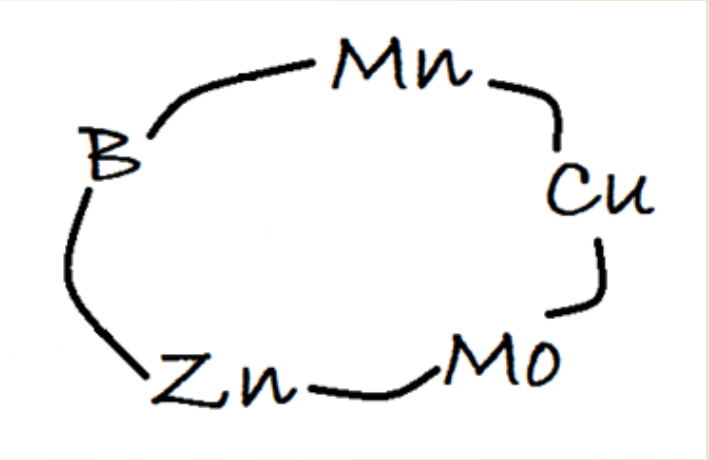
NUTRIENTS – MICRO ELEMENTS

Affect growth and development of plants as promoters and catalysers of biochemical reactions

- Their deficiency is manifested by various diseases

- Micro elements:
  - **Boron** → metabolism and synthesis of plant growth regulators
  - **Copper** → deficiency retards plant growth, causes withering of the plant
  - **Zinc** → deficiency causes metabolic disorders, including the development of growth regulators
  - **Molybdenum** → development of proteins
  - **Manganese** → production of leaves, fruits, and seeds



It is important to use organic fertilizers!

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COMPOST

Fertilizing of the soil is carried out every two years

- Correctly applied compost = support plant growth and health, haS a disinfecting effect
- Composted is all organic waste from the area, all weeds without developed seeds
- Plants infested with pests and diseases have to be burned, ashes can be added into compost
- Perennial species of weeds can be added to compost only after 2-3 weeks of fermentation in barrels with water

- It is recommended to add:
  - mature compost
  - chicken and pigeon droppings
  - herbal extracts (nettle, dandelion, camomile, oak bark)
- It speeds up maturing

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FAST COMPOSTING – COMPOST IN CONTAINERS

- All plant residues are cut up or crushed into 2-3 cm chunks
- Layers of compost:
  - drainage layer (straw, peat etc.)
  - in turns given green and withered plant residues – layer can be maximally 10-15cm high
  - each layer of organic material has to be limed and covered with topsoil or mature compost
  - keep adequately moist
- Compost must be regularly stirred
- Temperature of material in compost – ca 70°C
- Compost is mature in 3-4 months

Mature compost is dark, loose material, smells like meadow greensward

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LAZY COMPOST

- Ideal for this method is shady place – keep adequately moist
- Place should be fenced with wooden boards, bricks or net – allow air flow from all sides
- material for compost is gradually piled, the pile can be about 1m high
- Less labour for the establishment of compost

Maturation is longer, at least the whole season: one year and more

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VERMICOMPOST

Vermicompost is organic fertilizer formed in the digestive tract of earthworms

- Size of particles and volume of compost material after processing are significantly smaller
- Vermicompost contains similar micro-organisms as in healthy soil

By application of vermicompost we achieve

- Natural restoration of soil fertility
- Acceleration ripening of crops for 1-2 weeks
- Increase content of vitamin C and crop yields

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GREEN MANURE

It is incorporation of green plants, specifically grown for this purpose, into the soil

- It is the easiest and cheapest way, how to supply organic matter into the soil
- After the harvest of main crop follow plants suitable for green manure
- After growing up is the area mulched

Another way:

- Green manure can be realized as combination of main crops and cover crops
- After harvesting of vegetables, plants for green manure remain till end of the season

When choosing suitable plants for green manure, we take into account agro climatic conditions of the area and main purpose of green manure

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1. Which effect on plants does fertilizing have?

a) Plants don't react on fertilizing.

b) Fertilizing enriches the soil with nutrients accessible for plants throughout the vegetation period, yields are increased.

c) Fertilizing causes weakening of plants, formation of seeds is stopped.

2. What are features of good compost?

a) Has dark colour and stinks.

b) Has dark colour, is loose and smells like like turf.

c) Has green colour, is loose and stinks.

3. What doesn´t belong into the compost?

a) Vegetable scraps, oil, animal bones residues of meat.

b) Leaves from trees, twigs, mature compost.

c) Residues of meat, animal bones, oil, kitchen scraps, non-degradable waste, plant residues attacked by pests.

4. What does the word "vermikompost" mean?

a) Organic fertilizer formed in the digestive tract of earthworms.

b) Compost, which we believe was made correctly.

c) Compost, bought in shop with organic products.

5. What is green manure?

a) Ecological fertilizing.

b) Sowing of plants, which when grown are incorporated into the soil as manure.

c) Fertilizing with green algae.

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LESSON 5

PRODUCTION PLAN

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CONTENT

- What does rotation of crops mean?
- Pros and contras
- Production plan
- Rotation plan
- Mixed cropping
- Principles of planning of mixed cropping
- Test from Lesson 5

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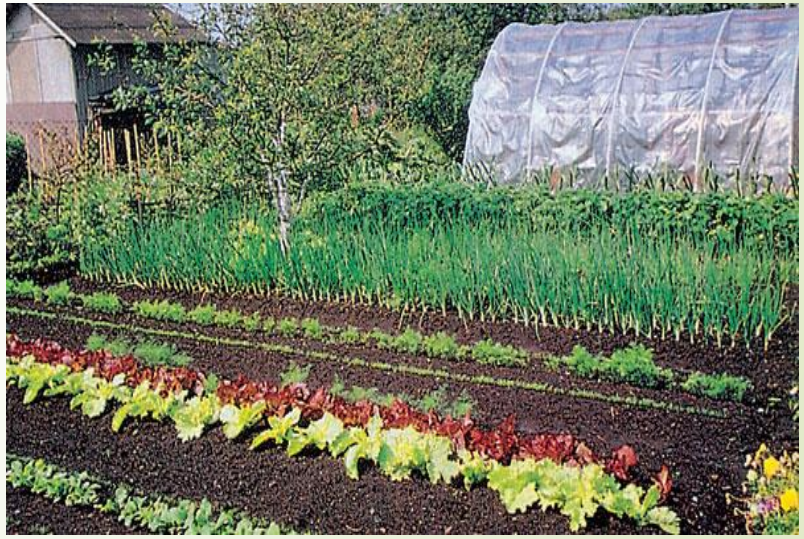
WHAT DOES ROTATION OF CROPS MEAN ?

Rotation of crops

- Securing of soil structure and fertility, vitality of grown crops, preventing pests and diseases
- As example we can look at natural ecosystem, for which huge diversity of types and species is typical

Natural ecosystem

Artificial ecosystem



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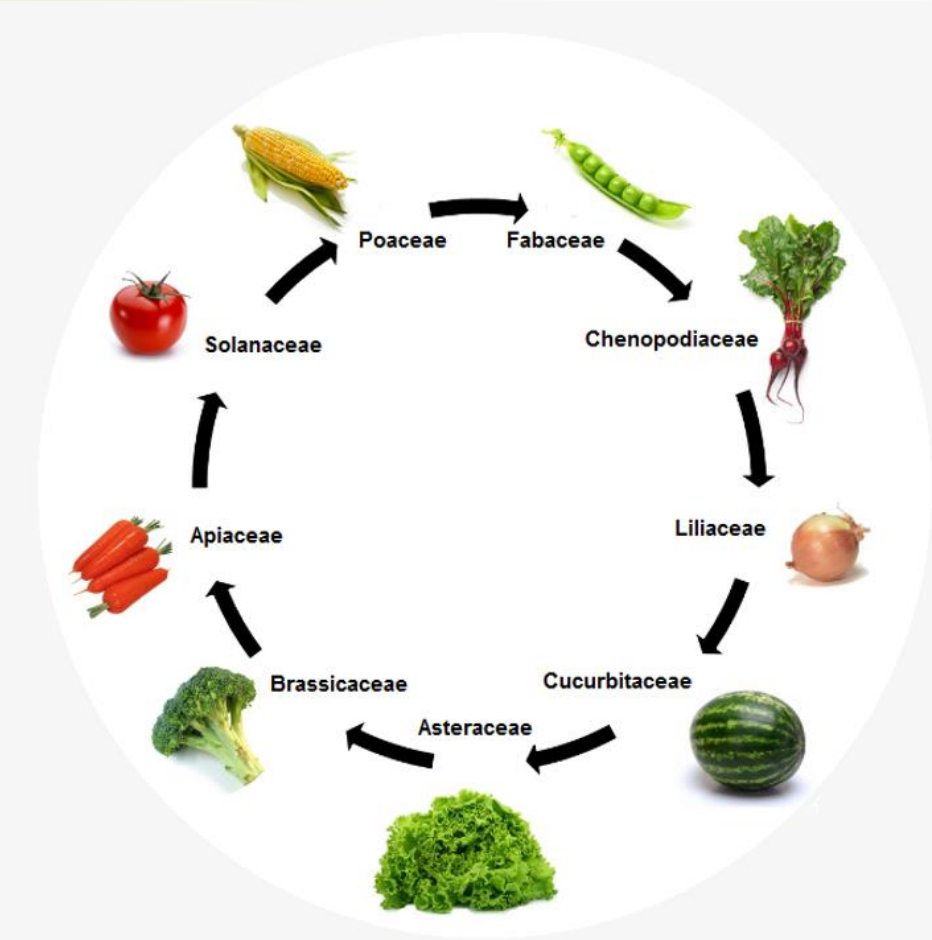
PROS AND CONTRAS



PROS

Rotation of crops means:

- more sustainable growing system
- more productive growing system
- less diseases and pests on plants
- prevention from build up of soil borne diseases
- improvement of soil structure
- prevention from soil depletion
- maintaining of field productivity
- keeping down weeds

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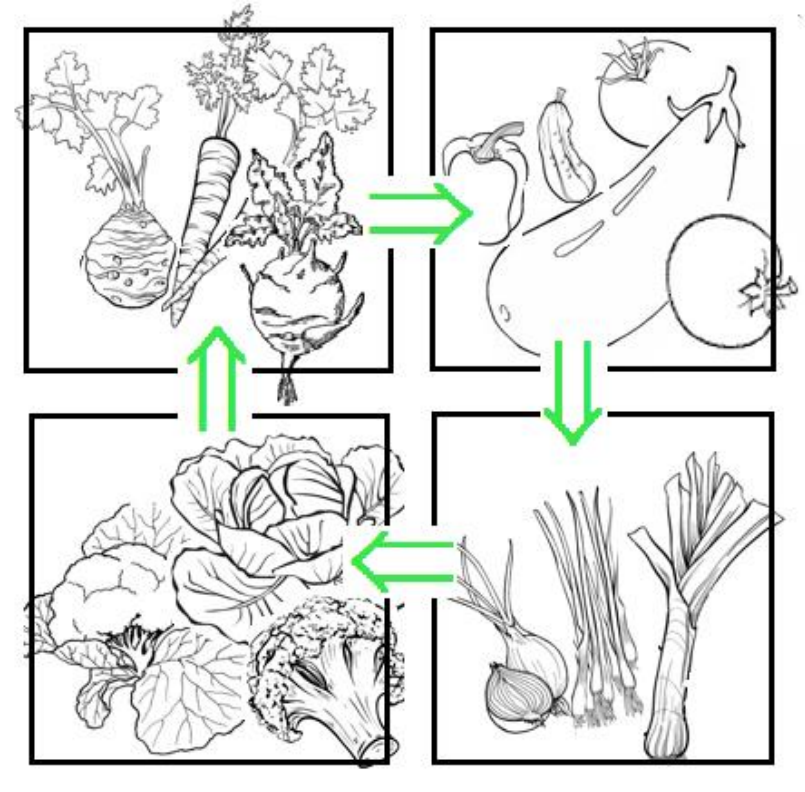
PROS AND CONTRAS



CONTRAS

Rotation of crops means:

- higher demands on organization
- higher demands on technical equipment
- higher economical demands-buying of seeds, plants, tools etc.
- higher demand on time – long term planning
- higher demands on evidence and monitoring

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PRODUCTION PLAN

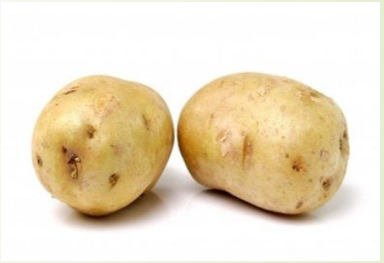
Decision what will be grown on which area within the same growing season

We divide:

Catch crops –with short vegetation period max. 3 months, (e.g. radish, lettuce), we harvest them end of spring or in autumn

Main crops – are on the area the longest time, we grow them after catch crops or after we harvest them subsequent crops follow on their place (tomatoes, pepper, potatoes)

Subsequent crops – are grown after main crops, (e.g. Chinese cabbage, spinach), coop well with frost and cold autumn weather



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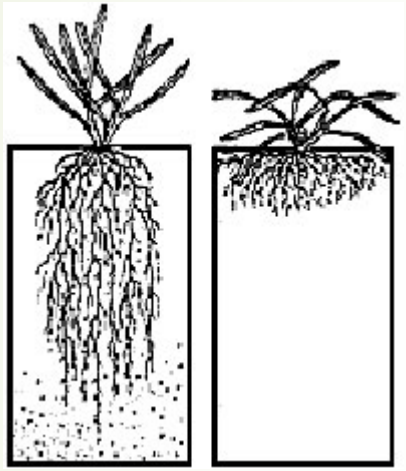
PRODUCTION PLAN



- Combination of deep rooting crops (e.g. tomatoes) with shallow rooting crops (e.g. lettuce, spinach)
- Combination of crops with bigger and smaller above earth part

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ROTATION PLAN

	1. YEAR	2. YEAR	3. YEAR	4. YEAR
Field Nr. 1	Brassicas	Root vegetables	Fruit vegetables	Legumes
				
Field Nr. 2	Root vegetables	Fruit vegetables	Legumes	Brassicas
				
Field Nr. 3	Fruit vegetables	Legumes	Brassicas	Root vegetables
				
Field Nr. 4	Legumes	Brassicas	Root vegetables	Fruit vegetables
				

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ROTATION PLAN

Rotation plan determines where each crop will be planted

- We divide area where crops will be grown into beds or rows and make a precise evidence
- Four year rotation plan should be base for our scheme, the same crop shouldn´t be planted on the same place for minimally 4 years
- We alter legume, leaf, root and fruit vegetables

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MIXED CROPPING

- Simultaneous cultivation of different types of plants (vegetables, flowers, herbs ....) in the same bed, side by side.
- German organic-grower Gertrude Franck found out Method of mixed cropping based on mutual tolerance and intolerance of plants
- Application of this method is suitable for growers of organic vegetables in smaller areas and community gardens
- This method allows to use all methods of organic farming (mulch, compost, natural pest control, targeted irrigation, ...)

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ROW MIXED CROPPING

- Less labour demanding and can be partially mechanized
- Plants are growing side by side in staggered rows
- Mixing main crop with a catch crop or catch crop with subsequent crops

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MIXED CROPPING PLAN

- Gaps after harvesting of crops are filled with expanded neighbouring plants or there are planted new seedlings manually
- Varied communities of cultivated plants on land where mechanical equipment hardly can be used

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PRINCIPLES OF MIXED CROPPING

- Some plants affect the growth of neighbouring and subsequent plants, in the positive as well as negative way
- Using knowledge about the interactions of plants is called allelopathy
- Basic principle of using of allelopathy is that we always plant main crop with helping plant species
- The need to respect agro-climatic and drowing technology conditions

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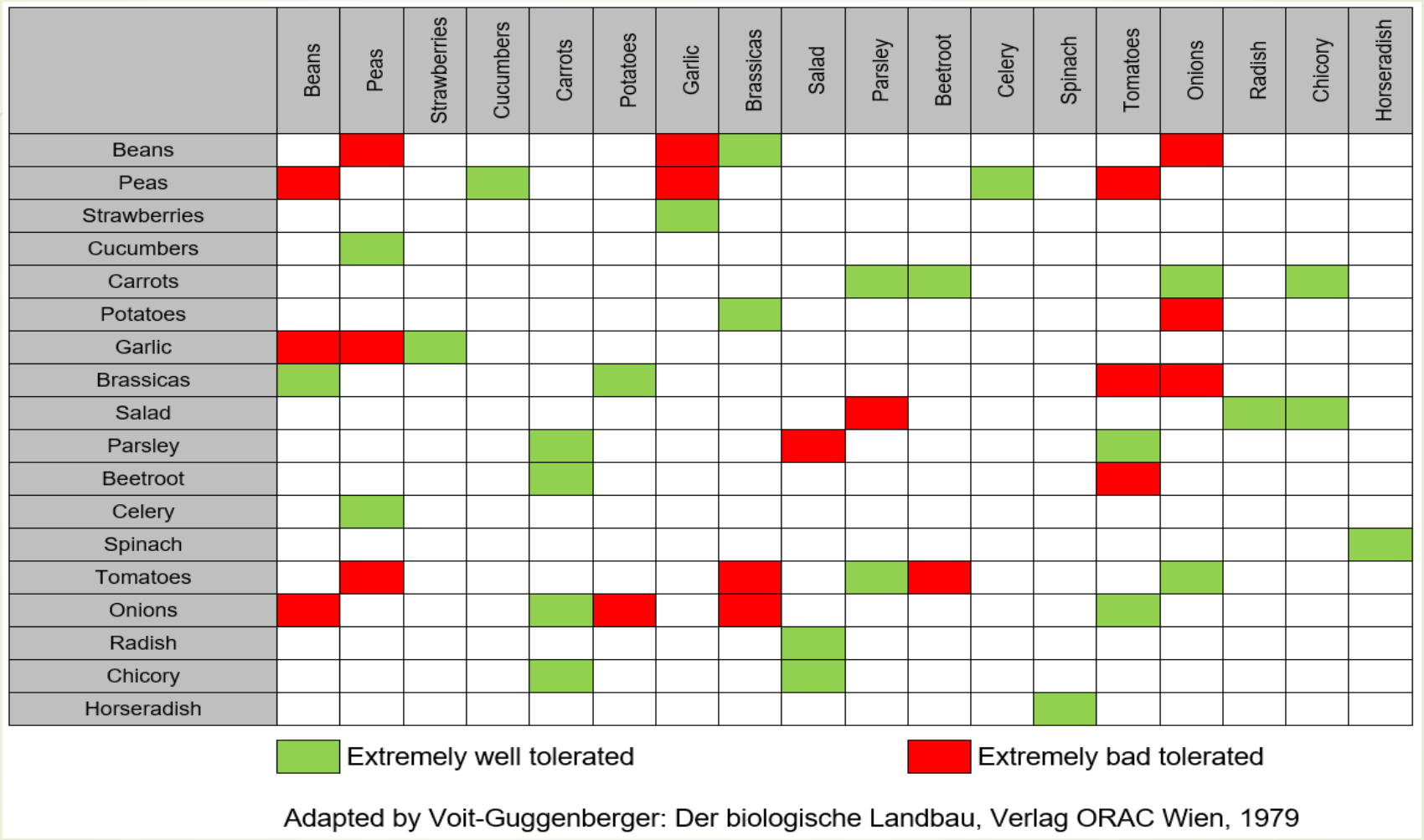
EXAMPLES OF INTERACTION



	Beans	Peas	Strawberries	Cucumbers	Carrots	Potatoes	Garlic	Brassicas	Salad	Parsley	Beetroot	Celery	Spinach	Tomatoes	Onions	Radish	Chicory	Horseradish
Beans																		
Peas																		
Strawberries																		
Cucumbers																		
Carrots																		
Potatoes																		
Garlic																		
Brassicas																		
Salad																		
Parsley																		
Beetroot																		
Celery																		
Spinach																		
Tomatoes																		
Onions																		
Radish																		
Chicory																		
Horseradish																		

Extremely well tolerated

Extremely bad tolerated

Adapted by Voit-Guggenberger: Der biologische Landbau, Verlag ORAC Wien, 1979

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TEST OF LESSON 5 Try online at

https://docs.google.com/forms/d/e/1FAIpQLSceko46LWyivFG7uD2tFXMJQRIP1QBhu50a1yoMKKH1T8toBg/viewform?usp=sf_link

1. Which vegetables are rotated within the rotation plan?

a) Brassicas, root, bulb, fruiting vegetables and legumes

b) Brassicas, legumes, tomatoes, weed

c) Parsley, beetroot, spinach, radishes

2. After what is named the four-year rotation plan??

a) After type of cultivation machine.

b) After seedbed with four sides

c) Why the same crop is grown on the same seedbed after four years.

3. Which features of plants in addition to their inclusion in the family should be respected?

a) Color of leaves, flowers and fruit.

b) Rooting depth, moisture requirements, the size of the above earth parts.

c) Rooting depth, size of fruits.

4. How are crops divided according to rotation plan?

a) Under crops, main crops, above crops

b) Catch crops, main crops, subsequent crops, intercropping.

c) Big crops, small crops, weed

5. How can be growing of vegetables in mixed cultures characterized?

a) Simultaneous growing of different kinds of plants (vegetables, herbs, flowers ...).

b) Growing of vegetables from prepared mixture of seeds.

c) Growing of vegetables before the community center.

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LESSON 6

SEEDS, SEEDLINGS, SPECIAL DEMANDS ON VEGETABLES

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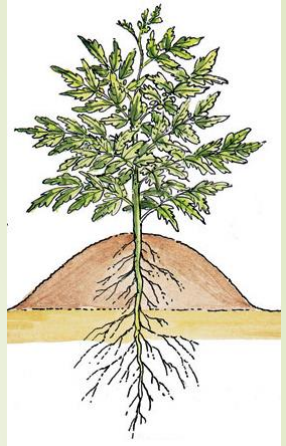
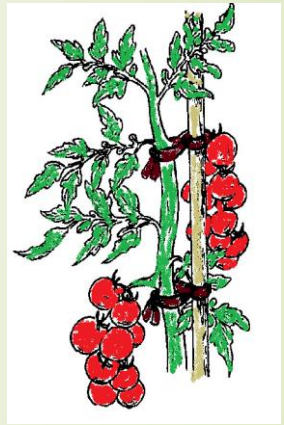
CONTENT

- Sowing of vegetables in ecological agriculture
- Direct sowing
- Methods of sowing
- The technique of direct sowing
- Pre-cultivation of seedlings in organic agriculture
- Taking care about pre-cultivation seedlings
- Methods and technique of planting seedlings
- Classification of vegetables to individual families
- Test from Lesson 6



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SOWING OF VEGETABLES IN ECOLOGICAL AGRICULTURE

The availability of seeds originating from organic farming is limited

- **It is needed to use**
  - seeds coming from accredited conventional farming
  - **seeds which are not chemically treated** against diseases of seedlings

- **Seed quality is determined by germination**

Energy of germination – the ability of seeds to germinate over time

- Acceleration of germination:
  - by soaking seeds before sowing
  - by germinating seeds before sowing

- **Quantity of seeds** – Amount of seeds needed for sowing on one unit area (kg/ha, g/m^2)

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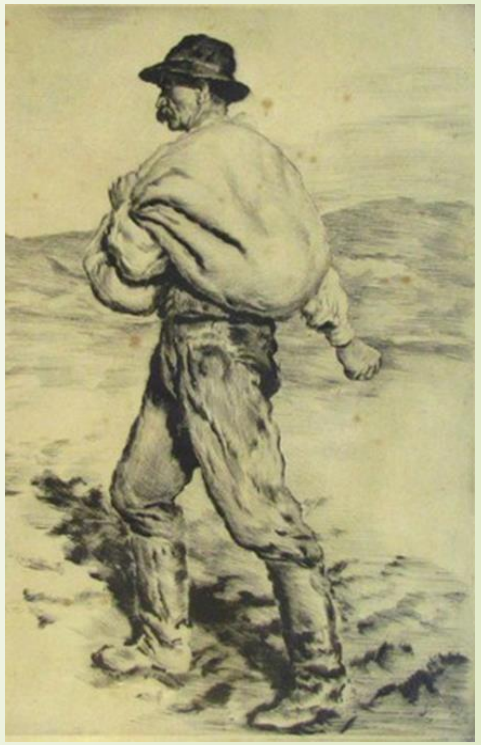
DIRECT SOWING

The term of planting is determined by claims of vegetable species regarding temperature and length of the growing season

- Spring sowing – as soon as possible in the spring (2nd half of March)
  - carrot, parsley, peas, spinach
  - later radishes, beans, pumpkins, zucchini, patizon
- Summer sowing – vegetables with shorter growing period - catch crops
  - early varieties of brassica, beetroot, Chinese cabbage, sweet fennel
- Autumn sowing – vegetables that can withstand wintering
  - spinach, lettuce to winter, carrot, parsley, onion



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METHODS OF SOWING

- **Broad casting**
  - seeds are scattered evenly all over the prepared field (green manure)
- **Line sowing**
  - rows in constant distance (carrots, parsley, parsnips, peas, pole bean, onion, radishes, beets, black radishes)
  - row spacing and plant to plant spacing – determined for each species and variety depending on used technology and plant requirements
- **Sowing in bunch**
  - bunch of seeds on one seeding place (rod beans, pumpkins, zucchini, patizon)

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THE TECHNIQUE OF DIRECT SOWING

- Preparation of the soil to a depth of maximum 5 cm
- Thorough weeding (mostly mechanical)
- Sowing with sowing machine or by hand – according to the size of the area
- Rolling the whole area flat after sowing
- Irrigation – important when sowing soaked or pre-germinated seeds

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PRE-CULTIVATION OF SEEDLINGS IN ORGANIC AGRICULTURE

- All thermophilic types of vegetables (tomatoes, peppers, eggplant, melons, cucumbers)
- Vegetable species with long growing season (celeriac, leek)
- Within a crop rotation – catch crop, main crop, subsequent crop (the main crop is planted on the habitat as a pre-cultivated seedling)

→

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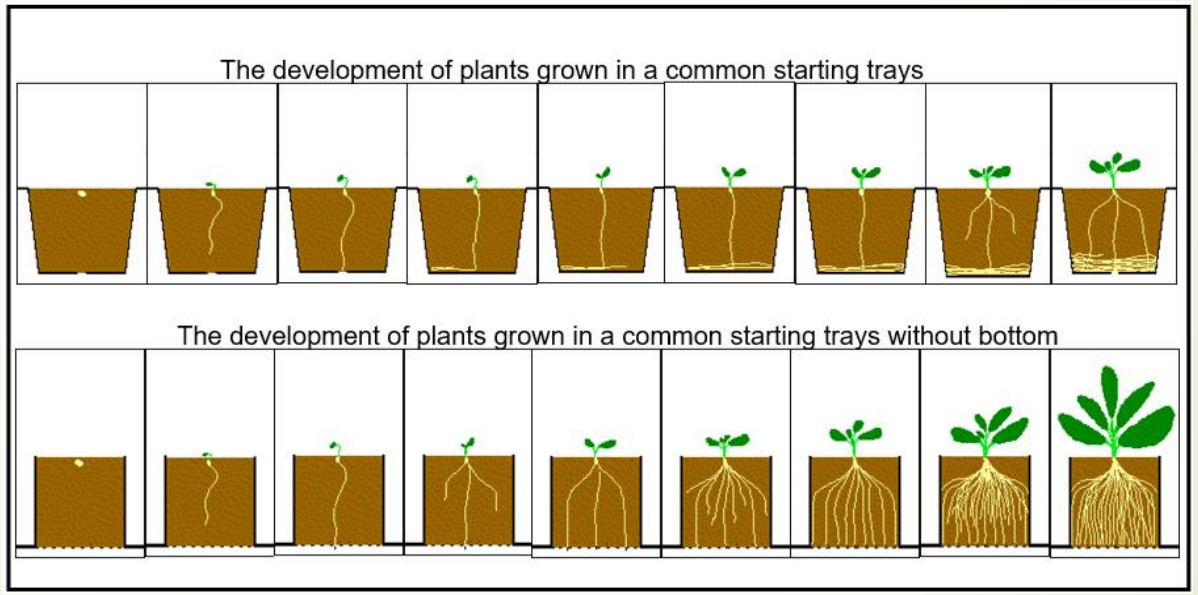
PRE-CULTIVATION OF SEEDLINGS IN ORGANIC AGRICULTURE

Different kinds of pre-cultivation of seedlings:

- Pre-cultivation of seedlings without separation
- Pre-cultivation of separated seedlings
- Pre-cultivation of seedlings in soil blocks
- Pre-cultivation of seedlings in seed starting trays
- Plastic seed starting trays without bottom



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TAKING CARE ABOUT PRE-CULTIVATION SEEDLINGS

- Compliance with optimal lighting conditions
- Temperature control – additional heating, ventilation
- Irrigation – maintaining humidity and uninterrupted growth of seedlings
- “Hardening” of seedlings – ventilated greenhouses, transferring seedlings to the sun during the day
- Preparation before planting – irrigation, fertilization
- Term of planting – determined by requirements of vegetable species and actual weather

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METHODS AND TECHNIQUE OF PLANTING SEEDLINGS

- **Methods of planting**
  - In lines, double lines, bunches
- **Planting patterns** – line spacing and plant to plant spacing
  - triangular,
  - square,
  - rectangular
- **The technique of planting**
  - into squares (with small hoe or shovel into previously indicated places)
  - into furrows (at equal distances to a pre-excavated furrow)
- **Proper planting depth**
  - deeper planting than pre-cultivated planting depth – tomatoes, brassica (except kohlrabi), leeks, cucumbers, melons, pumpkins
  - shallow planting – celery, kale, lettuce

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CLASSIFICATION OF VEGETABLES TO INDIVIDUAL FAMILIES

Family	Species
Apiaceae	Carrots, parsley, parsnips, celeriac, sweet fennel, anise, dill, coriander, cumin
Asteraceae	Salads, chicory, pepper, artichoke
Brassicaceae	Cabbage, red cabbage, cauliflower, Savoy cabbage, kale, Brussels sprouts, broccoli, white kohlrabi, blue kohlrabi, Peking cabbage, Chinese cabbage, round radish, elongated radish, summer radish, winter radish, watercress, horseradish
Cucurbitaceae	Cucumbers, gherkins, melons, watermelons, pumpkins, zucchini, patizon
Fabaceae	Beans, runner bean, soya bean, pea, wrinkled pea, sugar peas, lentils
Chenopodiaceae	Spinach, beetroot, chard, mangel beet
Aliaceae	Onion, shallot, leek, garlic, chives, asparagus
Poaceae	Corn
Solanaceae	Tomatoes, peppers, eggplants (aubergines), potatoes

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CLASSIFICATION OF VEGETABLES TO INDIVIDUAL FAMILIES

CARROT FAMILY (APIACEAE)

- **Vegetables:** Carrots, parsley, parsnips, celeriac, sweet fennel, anise, dill, coriander, cumin
- **Specific features:**
  - Most of the cultivated vegetable species of this family are biennials (two-years life cycle), grown from sowing
  - Given the slow initial development, they are threatened by growth of weeds
  - By all species of this family can also occur premature jut into bloom as reaction to low temperatures or growth depressions
  - Sweet fennel due to excessive daylight does not form edible parts

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CLASSIFICATION OF VEGETABLES TO INDIVIDUAL FAMILIES

ASTERALES (ASTERACEAE)

- **Vegetables:** green salad, romaine lettuce salad, ice salad, chicory, pepper, artichoke
- **Specific features:**
  - Vegetables of that botanical family tend to jut into bloom in conditions of “long day”
  - They don´t have high demands on temperature, but require sufficient amount of soil moisture
  - In areas with high humidity they are attacked by diseases
  - They are sensitive to sudden weather changes, especially varieties of leaf lettuce
  - Some vegetables from that family are shallow rooting (salads), others are deep rooting (chicory)

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CLASSIFICATION OF VEGETABLES TO INDIVIDUAL FAMILIES

CABBAGE FAMILY (BRASSICACEAE)

- **Vegetables:** cabbage, red cabbage, cauliflower, Savoy cabbage, kale, Brussels sprouts, broccoli, white kohlrabi, blue kohlrabi, Peking cabbage, Chinese cabbage, round radish, elongated radish, summer radish, winter radish, watercress, horseradish
- **Specific features:**
  - Vegetables of that botanical family are mostly biennial and in conditions of “long day” tend to jut into bloom
  - They are characterized by a rapid initial growth and intensive root formation, which has a positive effect on soil structure
  - Locations used to grow vegetables from this family remain

    relatively less weeded, than other areas
  - On the other hand is here higher risk in overgrowth of diseases and pests

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CLASSIFICATION OF VEGETABLES TO INDIVIDUAL FAMILIES

CUCURBITS FAMILY (CUCURBITACEAE)

- **Vegetables:** cucumbers, gherkins, melons, watermelons, pumpkins, zucchini, patizon
- **Specific features:**
  - The claims of this group of vegetables on climatic and soil conditions are very high, they require high temperatures, high air humidity, and well aerated soil humus
  - All species are very sensitive to frost
  - They are considered to be very fast growing crops, with shallow but quick growing root system
  - Due to the high leaf area they overshadow well the soil surface and thus prevent the growth of weeds
  - On the other hand continuous vegetation allows rapid spread of virus diseases

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CLASSIFICATION OF VEGETABLES TO INDIVIDUAL FAMILIES

LEGUMES FAMILY (FABACEAE)

- **Vegetables:** beans, runner bean, soya bean, pea, wrinkled pea, sugar peas, lentils
- **Specific features:**
  - Root nodules occurring on roots of plants from this botanical family hold atmospheric nitrogen with help of symbiotic nitrogen fixing bacteria and retain it for subsequent crops
  - Through quick growing root system they positively affect soil structure

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CLASSIFICATION OF VEGETABLES TO INDIVIDUAL FAMILIES

GOOSEFOOT FAMILY (CHENOPODIACEAE)

- **Vegetables:** spinach, beetroot, chard, mangel beet
- **Specific features:**
  - Vegetables of this botanical family are able to adapt well to local climatic conditions, but prefer more areas with high humidity and mild temperatures
  - Spinach, chard and beets are only slightly attacked by diseases and "pests"
  - Spinach as a “long day” plant grows in summer less, because at higher temperatures tends to jut into bloom
  - Spinach and beetroot are in early stages of development of high requirements to control weeds

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CLASSIFICATION OF VEGETABLES TO INDIVIDUAL FAMILIES

ALLIUM (ALIACEAE)

- **Vegetables:** onion, shallot, leek, garlic, chives, asparagus
- **Specific features:**
  - These vegetables have a very slow initial development and land remains a long time without continuous plant cover
  - Throughout cultivation they are not able to compete with weeds
  - Pre-cultivation of seedlings can shorten their growth in the field and improve their competitiveness
  - In areas with a high concentration of bulb vegetables is high risk of spreading fungal diseases

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CLASSIFICATION OF VEGETABLES TO INDIVIDUAL FAMILIES

NIGHTSHADES FAMILY (SOLANACEAE)

- **Vegetables:** tomatoes, peppers, eggplants (aubergines), potatoes
- **Specific features:**
  - Vegetables of this botanical family are very demanding to heat and light
  - Temperature optimum ranges in values 22-27°C (minimum 15°C)
  - In field conditions they can be grown only in the hottest areas
  - In protected area of greenhouses, their growing can be extended to less warm areas under condition that temperature and relative air humidity are controlled and regulated, to avoid dewing
  - Commercially raised beneficial organisms can be used for biological pest control

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TEST FROM LESSON 6 Try online at

https://docs.google.com/forms/d/e/1FAIpQLSeayY6FqYAY1AUHweT6-r42--DvN0ok2jn5lwmPHRUklfNcew/viewform?usp=sf_link

1. According to what we choose term for sowing and planting?

a) Advice from neighbor or what we read in journal.

b) Demands on germination temperature, length of vegetation period, ability of seedling to withstand frost.

c) Sowing and planting is done as soon as the soil is prepared.

2. What kinds of sowing are known?

a) Broad casting, line sowing, sowing in bunch.

b) Sowing broad and long.

c) Sowing with seeder.

3. Advantages of autumn sowing compared to spring sowing are?

a) Seeds are in autumn cheaper.

b) We remember placement of plants and can rotate them properly.

c) Part of work can be done in advance, plants can in spring use winter moisture, we can harvest sooner.

4. Advantages of pre-cultivation of seedlings are?

a) Plants grow in protected environment, we can choose only strong ones, increased resistance of seedlings against weed and pests, some vegetables without pre-cultivation could not grow in our conditions.

b) Seeding of pre-cultivated plants is more convenient.

c) There is no need for watering the whole bed, just boxes with seedlings.

5. Disadvantages of pre-cultivation of seedlings are?

a) Lack of care may kill them.

b) Pre-cultivation of seedlings is laborious, long and economically more challenging than sowing.

c) We use less seeds than by sowing directly into the bed.

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LESSON 7

PROTECTION OF VEGETABLES AGAINST DISEASES AND PESTS IN ECOLOGICAL AGRICULTURE

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CONTENT

- Basic principles
- Prevention
- Direct protection against pests
- Phyto therapy - using liquors or extracts of certain plants
- Direct protection against diseases
- Test from Lesson 7

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BASIC PRINCIPLES

- Sufficiently strong and healthy plants = naturally resistant
- The essence of plant protection is primarily prevention
- Use of “natural predators”
- Creating optimal conditions = perfect planning

	1st year	2nd year	3rd year	4th year
Beet Nr.1	Brassicas	Root vegetables	Fruit vegetables	Legumes
Beet Nr.2	Root vegetables	Fruit vegetables	Legumes	Brassicas
Beet Nr.3	Fruit vegetables	Legumes	Brassicas	Root vegetables
Beet Nr.4	Legumes	Brassicas	Root vegetables	Fruit vegetables
LEGEND		manured	not manured	green manure

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BASIC PRINCIPLES

- Careful and regular monitoring of the state of vegetation
- Elimination of agro-technical failures (soil compaction, lack or too much fertilization or irrigation)
- Organic vegetable production is subject to comprehensive protection of plants

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PREVENTION

- Land care and care for ecosystem
- **Enhancing of biodiversity** and increase of such types of **organisms** that help to maintain ecological **balance** of the ecosystem (spiders, ladybugs, lacewings, parasitic wasps, singing birds, hedgehogs, lizards, etc.)
- Selection of suitable varieties
- Crop rotation
- Proper fertilization and tillage = good agricultural practice

USEFUL ANIMALS

Hedgehog

Ground beetle

Lizard

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DIRECT PROTECTION AGAINST PESTS

- Excludes the use of biocides
- Chemical means of protection – only authorized products listed for organic production and only in “emergency case”
- Mechanical protection of vegetables = using non-woven textiles and protective nets (prevent access of flying insects)
- Mechanical control of "pests“ (light traps, sticky bands, sticky boards, gathering of "pests")
- Biological methods of plant protection – use of parasitic wasps “Aphidius colemani”
- Use of micro-organisms “Bacillus thuringiensis”
- It is necessary to apply these organisms in time

PESTS

Mite Phytoselulus persimilis

Wasp Aphidius colemani

Wasp Encarsia formosa

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PHYTO THERAPY - USING MACERATES OR EXTRACTS OF CERTAIN PLANTS

- From fresh or dried plants medicines are prepared in several ways:
  - **Fermented macerate** – plants are dipped for 2-3 weeks in water
  - **Fermented water extract** – plants are dipped in water for 2-3 days
  - **Infusion** – plants are dipped in hot water at least 24 hours
  - **Concoction** – plants are boiled after dipping in water
  - **Macerate** – flowers of plants are dipped in cold water for 3 days
  - **Extract** – flowers or inflorescence are cut or processed in mixer and decanted through sieve
- So prepared preparations from plants can be used either in undiluted or diluted form

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Several examples of the use of Phyto therapy

Plant and used parts	Application	Impact
Marigold (Tagetes), whole plant in flowering time	3kg of dry plants steep in 10 l of warm water and macerate 48 hours	Fungal diseases, aphids on berry fruits
Garlic (Alium sativum), pods	150 g of crushed garlic steep in 10 l water, macerate 24 hours, add 100 g soft soap, stir and filtrate. Spray with undiluted solution	Bacterial diseases, aphids, mite, rust
Onion (Alium cepa), whole plant	a) 500 g steep in 10 l of water, macerate 24 hours, thin with water 1:10, treat the soil after first occurrence b) 200 g steep in 10 l of water, spray with undiluted solution in time of insect rides	Fungal diseases, (strawberries, potatoes e.g.) wireworm
Greater burdock (Armoracia rusticana), leaves and roots	3 kg of leaves steep in 10 l of water, macerate 3 days, filtrate	Caterpillar on cabbage, radish and other species
Forking Larkspur (Consolida regalis) whole plant	1 kg of dry plants collected in time of flowering, steep in 10 l of water, macerate 48 hours, filtrate, use immediately	Caterpillars, cabbage moth, cabbage butterfly, etc.
Wormwood (Artemisia absinthium) plant and flowers	a) 300 g of fresh or 30 g of dry plants steep in 10 l of water, macerate 4 days, spray with undiluted solution in spring or autumn b) Use the above described solution, add 1% of liquid glass, spray with undiluted solution in spring and autumn c) Use solution described in b), spray in time of insect rides	Caterpillars, ants Mites on strawberries Cabbage butterfly

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DIRECT PROTECTION AGAINST DISEASES

- The most common originator of vegetable diseases are **fungi**, **bacteria** and **viruses**
  - the most important protective measure is **prevention**:
  - avoid closed locations with high humidity
  - choose resistant varieties
  - let more space between rows

- **Diseased plants should be immediately removed and liquidated** (put into hole and sprinkle with lime to prevent further spread of the disease)

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TEST FROM LESSON 7 Try online at

https://docs.google.com/forms/d/e/1FAIpQLSecX7jCDM6mneoQp_f0HLkjOUzgALRmMhbA98_MwpJOzVySRg/viewform?usp=sf_link

1. What are the ways to protect plants against pests and diseases?

a) Immediately after finding out we use chemical sprays.

b) Means are limited, the best way is to wait how the situation will evolve on neighbouring areas.

c) Prevention, direct protection, indirect protection.

2. List forms of prevention.

a) Careful planning, evidence, choice of appropriate varieties, monitoring.

b) Monitoring of expert journals and meteorological reports.

c) Gaining of experience, verification of information and advice etc.

3. What are possibilities for indirect protection of plants?

a) We ensure that beds did not get pests and diseases from neighbouring areas.

b) We promote the occurrence of beneficial insects and animals, we care for crops and dispose contaminated plants.

c) We do not interfere unnecessarily in plants.

4. What is direct protection of plants against pests?

a) We cover beds with non-woven textiles and nets, plant protecting plants, use sticky strips or collect pests manually, use predatory insects, Phyto-therapy, allowed sprays etc.

b) We move plants into safer locations.

c) We sow and plant only vegetables not attacked by pests.

5. How can be plants protected from diseases?

a) Using increased quantities of chemicals.

b) We create for plants as optimal conditions as possible and use permitted sprays.

c) Plants cannot be protected in any way.

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LESSON 8

IRRIGATION OF VEGETABLES IN ECOLOGICAL AGRICULTURE

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CONTENT

- Need of water by growing of vegetables, types of irrigation
- Principles of irrigation in ecological agriculture
- Important rules for irrigation
- Technique of irrigation in ecological agriculture
- Mikro-irrigation systems
- Disadvantages of mikro-irrigation systems
- Final test

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NEED OF WATER BY GROWING OF VEGETABLES, TYPES OF IRRIGATION

- Total water demand – optimal amount of water for natural development and achieving high crops
- Differences in water demand by:
  - the type of vegetable
  - the time of year
  - the soil type and climatic conditions in the area

- 4 categories of vegetables:
  - with high water demand and great ability to get it from soil (melons, beets)
  - with high water demand and low ability to get it from the soil (salads, spinach, brassicas)
  - with average water demand and good ability to obtain soil water (carrot, parsley)
  - with low water demand (beans, garlic)

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NEED OF WATER BY GROWING OF VEGETABLES, TYPES OF IRRIGATION

- How it should not be done...

...how it is impossible to do in large scale.

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Examples of irrigation regime of chosen crops

Crop	Critical period	Total water demand [mm]	Irrigation amount [mm]	Irrigation dose [mm]	Irrigation cycle [days]
Pepper					
- vegetable	VII- VIII	500 – 600	250 – 600	35	7
- herb	VII – 20.VIII	450 - 500	200 - 250	30	10
Cucumber					
- salad sort	15.VII – VIII	300 – 400	100 – 150	30	12
- pickles	10.VII - VIII	350 - 450	150 - 200	25	8
Brassicas					
- early	V –10.VI	100 – 150	50 – 80	20	12
- medium early	V – VI	200 – 300	80 – 110	30	12
- medium late	VI –VIII	300 – 450	110 – 160	30	8
- late	VII – VIII	450 – 550	150 – 220	40	12
- kale	VI - VIII	550 - 650	180 - 250	30	8
Celeriac	VI - VIII	550 - 650	220 - 320	30	8

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PRINCIPLES OF IRRIGATION IN ECOLOGICAL AGRICULTURE

- Basic principles of irrigation:
  - awareness of water demand of individual groups of species, cultivars and hybrids of vegetables
  - determination and compliance with proper irrigation system
  - use of appropriate irrigation techniques
  - respect for principles of protection and nutrition of plants
  - use of appropriate irrigation techniques and ensuring good organization of work

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IMPORTANT RULES FOR IRRIGATION

- Watering should be carried out thoroughly and on time
- Water during irrigation cannot stay on the soil surface
- During flowering period of vegetables irrigation by spraying shouldn´t be performed
- Water must not contain hazardous substances (heavy metals, PCBs, DDT)
- Water should not contain pathogens and weed seeds
- Water temperature can be at most 5 °C lower than the temperature of the soil
- During the growing season it is preferable to combine irrigation with manuring

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TECHNIQUE OF IRRIGATION IN ECOLOGICAL AGRICULTURE

- Measurement of soil moisture by moisture sensors or by water demand calculations (according to rainfall, air temperature, relative humidity, soil type)

  ↓

  efficient use of irrigation water

- The choice of a technical solution with regard to irrigation:
  - size of irrigated area
  - shape and slope of land, terrain obstacles
  - soil conditions
  - organization of crops – types of vegetables, farming options

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MIKRO-IRRIGATION SYSTEMS

- Water is supplied in a small amount directly to the root system of irrigated plants
- Types of drip irrigation: Micro-irrigation is a broader term that is used to cover all forms of small emission devices including **individual emitters**, **row-crop tubing**, **spray strakes** and **micro-sprinklers**

- Benefits of drip irrigation:
  - water savings compared to spraying are 30 - 50 %
  - precise dosing of water in accordance with needs of plant
  - energy and material savings (pipes, valves, fittings)
  - low intensity of irrigation without causing soil erosion
  - weed infestation is reduced
  - area between beds is not drenched – better access for people and mechanisms
  - it is possible to use irrigation with fertilizer, air-conditioning irrigation and other
  - possibility of full automation
  - the incidence of diseases and pests is reduced

Individual emitters

Row-crop tubing

Spray strakes

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DISADVANTAGES OF MIKRO-IRRIGATION SYSTEMS

- Higher investment costs
- point irrigation – uneven distribution of water over the surface – local waterlogging
- drip irrigation and micro spraying – clogging of small outlet openings by dirty water
- High demands on the quality of irrigation water from point of view:
  - mechanical (suspended solids)
  - chemical (precipitated substances)
  - biological (microbial bacteria, algae, slime)
  - where for technical or economic reasons it is not possible to provide the required purity of the water, drip irrigation system should be replaced by other irrigation systems

Amateur way how to avoid drawbacks of micro-irrigation

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FINAL TEST Try online at https://docs.google.com/forms/d/e/1FAIpQLSfztmQXYsE8uDym_0PRVPXZ-nFKdJrhJzaSc6obOizntBT_Mw/viewform?usp=sf_link

1. Which law defines conditions of organic farming in Slovakia?

a) Decree of Ministry of Agriculture of the Slovak Republic from October 1st 1999 no. 3259/1999.

b) Act no. 421/2004 Coll., called "Competence Act".

c) Act no. 224/1988 Coll., on organic farming and organic food production.

2. Who ensures control in organic farming in Slovakia?

a) Ministry of Agriculture of the Slovak Republic.

b) Slovak Trade Inspection.

c) Other authorized and certified institution.

3. What is the difference between organic and sustainable agriculture?

a) They don´t have nothing in common with each other.

b) Organic farming is perceived as an integrated component of sustainable agriculture.

c) Sustainable agriculture is an integrated component of organic farming.

4. In which regard is own organic vegetable better than vegetable accessible in shop?

a) It is effortless accessible in shops.

b) It is tastier, with higher content of nutrients, provides better feeling based on own effort

c) It is cheaper, has higher content of chemicals and vitamins

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FINAL TEST

5. What is the difference between family farm and community garden?

a) There is no difference between them.

b) Difference is in the ownership of the land.

c) Difference is in the ownership of the land and decision-making competencies.

6. What are features of soil ideal for growing vegetables?

a) Light to medium, slightly humic, sandy or loamy with humus content 3-5% and neutral soil reaction (pH 6,5-7,3), well permeable to water and air and with good water capillarity.

b) Heavy, waterlogged soil, full of stones.

c) Sandy, light, easy to work with, dries and warms up quickly.

7. Which kinds of soil do we know in dependence of a number of mineral particles?

a) Light, medium, heavy and neutral.

b) Sandy, loamy sand, sandy loam, loam, silt loam, clay loam, clayey.

c) Sandy, acidic, loamy, alkaline, clayey, neutral.

8. What is optimal location for organic farming?

a) Location more than 350m above sea level, protected, light to medium soil, ground water at a depth of about one meter.

b) Each location under 1350m above sea level after necessary treatment.

c) Location under 350m above sea level, protected, with layer of topsoil from 0,4 to 0,6m, ground water at a depth of about one meter.

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FINAL TEST

9. Is it possible to influence quality of our soil?

a) Yes.

b) No.

c) Yes, by the addition of chemical fertilizers, pesticides and herbicides.

10. What kinds of vegetables can be grown in acidic soil?

a) All kinds of vegetables without exception.

b) Brassicas and root vegetables.

c) Acidic soil is not suitable for any kind of vegetables with exception of leguminous plants, which tolerate slightly acidic reaction.

11. What kinds of improvement of soil quality are suitable by organic farming?

a) Use of organic matter as natural fertilizers, liming with dolomitic limestone, green manure.

b) Use of fertilizers, chemical sprays for combating weeds and pests.

c) Nothing, nature can deal with it on its own.

12. What are biggest disadvantages of plowing in organic farming?

a) Plowing is loud and demanding on fuel consumption.

b) Plow turns the soil upside down, what causes destruction of microorganisms and worsening of soil structure.

c) Plowing doesn´t have disadvantages.

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FINAL TEST

13. What does mechanical improvement of soil mean?

a) Mechanical manuring.

b) Eradication of weeds.

c) Improvement of soil structure, incorporation of crop residua, adjustment of compacted soil.

14. What is the main goal of soil cultivation before sowing and planting?

a) Aesthetic shape and colour of seedbeds.

b) Weed control, cleaning of seedbeds.

c) Securing of appropriate conditions for growing and protection of sown and planted seedlings.

15. Main principles of cultivation with sweep cultivator are?

a) We cultivate shallow, by nice weather, as close to the row of crops as possible, each time when necessary.

b) We cultivate shallow, only after the rain, once a year.

c) Cultivation is not necessary.

16. Assets of no–till farming system are?

a) We can re-use a lot of old carpets and newspapers.

b) We improve microbial structure of soil and don´t need to agitate soil mechanically.

c) We don´t need to care about compost.

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FINAL TEST

17. Which effect on plants does fertilizing have?

a) Plants don’t react on fertilizing.

b) Fertilizing enriches the soil with nutrients accessible for plants throughout the vegetation period, yields are increased.

c) Fertilizing causes weakening of plants, formation of seeds is stopped.

18. What are features of good compost?

a) Has dark colour and stinks.

b) Has dark colour, is loose and smells like turf.

c) Has green colour, is loose and stinks.

19. What doesn´t belong into the compost?

a) Vegetable scraps, oil, animal bones, residues of meat.

b) Leaves from trees, twigs, mature compost.

c) Residues of meat, animal bones, oil, kitchen scraps, non-degradable waste, plant residues attacked by pests.

20. What does the word “vermikompost” mean?

a) Organic fertilizer formed in the digestive tract of earthworms.

b) Compost, which we believe was made correctly.

c) Compost, bought in shop with organic products.

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FINAL TEST

21. What is green manure?

a) Ecological fertilizing.

b) Sowing of plants, which when grown are incorporated into the soil as manure.

c) Fertilizing with green algae.

22. Which vegetable species are rotated within the production plan?

a) Brassicas, root, leaf, fruit vegetables and legumes.

b) Brassicas, legumes, tomatoes, weed.

c) Parsley, beetroot, spinach, radish.

23. After what is named the four-year rotation plan?

a) After type of cultivation machine.

b) After seedbed with four sides.

c) Because of the same crop is grown on the same seedbed after four years.

24. Which features of plants in addition to their inclusion in the family should be respected?

a) Colour of leaves, flowers and fruits.

b) Rooting depth, moisture requirements, the size of the aerial parts.

c) The size of fruits that we want to achieve.

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FINAL TEST

25. How are vegetable species distinguished according to rotation plan?

a) Under crops, main crops, over crops.

b) Main crops, subsequent crops, catch crops.

c) Big crops, small crops, weed.

d)

26. How can be growing of vegetables in mixed cultures characterized?

a) Simultaneous growing of different kinds of plants (vegetables, herbs, flowers ...).

b) Growing of herbs in a premixed mixture of seeds.

c) Growing of vegetables before the community center.

27. According to what we choose term for sowing and planting?

a) Advice from neighbour or what we read in journal.

b) Demands on germination temperature, length of vegetation period, ability of seedling to withstand frost.

c) Sowing and planting is done as soon as the soil is prepared.

28. What kinds of sowing are known?

a) Broad casting, line sowing, sowing in bunch.

b) Sowing broad and long.

c) Sowing with seeder.

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FINAL TEST

29. Advantages of autumn sowing compared to spring sowing are?

a) Seeds are in autumn cheaper.

b) We remember placement of plants and can rotate them properly.

c) Part of work can be done in advance, plants can in spring use winter moisture, we can harvest sooner.

30. Advantages of pre-cultivation of seedlings are?

a) Plants grow in protected environment, we can choose only strong ones, increased resistance of seedlings against weed and pests, some vegetables without pre-cultivation could not grow in our conditions.

b) Seeding of pre-cultivated plants is more convenient.

c) There is no need for watering the whole bed, just boxes with seedlings.

31. Disadvantages of pre-cultivation of seedlings are?

a) Lack of care may kill them.

b) Pre-cultivation of seedlings is laborious, long and economically more challenging than sowing.

c) We use less seeds than by sowing directly into the bed.

32. What are the ways to protect plants against pests and diseases?

a) Immediately after finding out we use chemical sprays.

b) Means are limited, the best way is to wait how the situation will evolve on neighbouring areas.

c) Prevention, direct protection, indirect protection.

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FINAL TEST

33. List forms of prevention.

a) Careful planning, evidence, choice of appropriate varieties, monitoring.

b) Monitoring of expert journals and meteorological reports.

c) Gaining of experience, verification of information and advice etc.

34. What are possibilities for indirect protection of plants?

a) We ensure that beds did not get pests and diseases from neighbouring areas.

b) We promote the occurrence of beneficial insects and animals, we care for crops and dispose contaminated plants.

c) We do not interfere unnecessarily in plants.

35. What is direct protection of plants against pests?

a) We cover beds with non-woven textiles and nets, plant protecting plants, use sticky strips or collect pests manually, use predatory insects, Phyto-therapy, allowed sprays etc.

b) We move plants into safer locations.

c) We sow and plant only vegetables not attacked by pests.

36. How can be plants protected from diseases?

a) Using increased quantities of chemicals.

b) We create for plants as optimal conditions as possible and use permitted sprays.

c) Plants cannot be protected in any way.

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FINAL TEST

37. How do we divide vegetables according to its water demands and ability to gain it from soil?

a) Vegetables able to obtain water from air moisture, vegetables with deep root system without water demands, vegetables with shallow root system with high water demands.

b) Thermophilic vegetables, hydrophilous vegetables, vegetables without specific water demands.

c) Vegetables with high water demands and great ability to get it, vegetables with high water demands and little ability to get it, vegetables with average water demands and good ability to get it, vegetables with low water demand.

38. How could be micro irrigation defined?

a) Micro irrigation system means, that water is delivered in small amounts directly above or into root system of the plant

b) Micro irrigation is system using micro drops delivered on the surface of the soil by means of sprinklers

c) Micro irrigation is system using biogenic elements to deliver necessary amount of water

39. What can be understood under collocation "Total water demand"?

a) Difference between average amount of rainfalls in given month and actual amount of rainfalls.

b) Total amount of water delivered throughout the previous vegetation period.

c) Optimal amount of water throughout the whole vegetation period needed by plant to ensure its growth, development and high yields.

40. Which types of micro irrigation are mostly used in ecological agriculture?

a) Individual emitters, row crop tubing, spray strakes and micro sprinklers.

b) Irrigation of the whole area with micro sprays and irrigation of beds.

c) Micro irrigation of rows, nests and beds.

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