



INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ



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

IRRIGATION OF VEGETABLES

- **A significant intensification factor that affects:**
 - **The amount and quality of production**
 - In the case of cucumbers, the quality and profit are higher by 30-50 %
 - Fruits are not deformed, bitterness is minimal
 - **Better utilisation of nutrients**
 - **Irrigation allows the dosing of liquid fertilisers**
 - **An increase in the effectiveness of certain herbicides**



Every deviation from the optimum water regime has negative effects

- **WATER SURPLUS**

- Expressing of air from the soil
- Deterioration of root metabolism
- Leaf chlorosis
- Root cracking
- higher occurrence of fungal diseases



WATER DEFICIENCY

- Wilting
- Deformation of fruits
- Spongy root structure
 - Dehydration of cells appears, water is drawn from the roots – permanent damage – typical of celeriac – formation of crater-like holes
- Bitterness of fruits
- Defoliation in thermophilic vegetables
 - Tomatoes, peppers, beans (need of a repeated sowing)
- Low pollen germination
- Deficient development of seeds in pods
 - Peas – if there are not more than five seeds in a pod, the peas are of second-rate quality, if there are fewer, it is non-standard quality – at a lack of pollen capable of germination, no seeds form



WATER

- **Wholesome**
- **Any water that does not contain organic impurities**

- **Sewage water is absolutely unusable – organic pollution**

- **Surface water** – excellent – rivers, brooks, ponds, water planes, surface water is warm and does not contain a lot of minerals or harmful substances



- **Water from nuclear power stations** – perfect for watering
 - Temperature of up to 23°C, safe

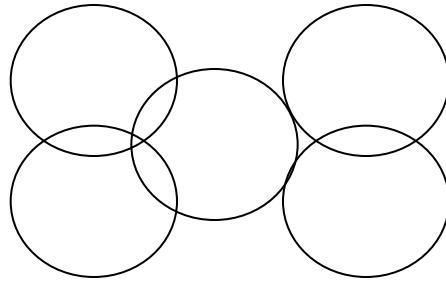


Ground water (well water) – “better than nothing”, this water is cold, hard; pump the water into a tank and let it warm; it is not possible to use the water for watering fruit bearing vegetables – after it evaporates, **films (Ca, Fe)** emerge – the fruits are unmarketable



Irrigation Methods

1. Spraying



- **Circle sprinklers**

- Water does not get to some spots that stay dry
- Some spots where the circles are overlapping get soggy

- **Hose-reel irrigators**

- More advantageous – more regular irrigation







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2. Subsurface irrigation

- A system of furrows into which water is drawn
- **Utilisation of water of only 40%**, the rest evaporates

3. Drip irrigation

- 40-120,000 plants per 1 ha – **it is difficult to see to the tubing**
- On small stretches of land only – seed production areas, special cropping, etc.
- Need to **clean water** thoroughly and eliminate Fe and Ca ions

Irrigation costs

- 2.50 to 3 CZK for cubic meter of water
- If a rainfall deficit is established, water is distributed free of charge

Cautious Management of Water Resources Is Essential

1. Strengthen the **natural water-holding capacity of soil** by increasing the levels of organic substances – **humus retains water**

- The greater the proportion of organic matter in the soil, the larger the water-holding capacity
- **The content of humus of above 3% is good, of above 5% excellent**
- **With arable crops whose growing period ends early**, there is additional time left until the end of the growing period – if the land is left fallow, weeds thrive, but planting a **mixture** means a favourable enrichment of the soil with organic matter and the land does not get covered with weeds

2. Mechanical measures

- **Inter-row hoeing, hoeing**

- By loosening of about 4 cm of soil
- Disruption of the capillarity and a reduction in evaporation
- Aerating the soil allows a more effective utilisation of nutrients

❖ v Israel – 7% of humus in the soil – that soil will not settle down, but the soil in the Czech Republic does, and inter-row hoeing is necessary

3. Use of resources to **limit the harmfulness of evaporation from the soil surface** (mulch, chop)

- **Mulching** is reasonable, but is very demanding on large expanses of land – non-woven fabric, bark, straw (rodents)
- Efforts to limit irrigation – non-woven fabric reduces evaporation which means a saving in costs

The Most Frequent Drawbacks of Vegetable Irrigation

- Too small or too large an amount of water
 - Ideally 15-30 mm, not 40 mm or 5-10 mm
 - More than 30 mm – the soil becomes boggy – a crust
 - Fewer than 10 mm – harmful evaporation when the weather is sunny is 8 mm
 - **15 mm** for shallow-rooted vegetables (lettuce, kohlrabi, small radishes, peppers)
 - **30 mm** for deep-rooted vegetables (cole crops, tomatoes)
 - **Cole crops** having a wax layer do not require irrigation more frequent than three times a month

Irrigation Time

- **Until 3-4 pm** so that leaves can dry by the evening
- **Cole crops, onions, and leeks**, having a wax layer, can be irrigated all day – water drops off the leaves
- As soon as the available water-holding capacity falls below 50%
 - **Strain gauge** shows negative pressure values; irrigation starts according to the value of negative pressure set as critical
 - The service **AGROMET SERVIS**
- Usually set by approximation

Irrigation Requirement

- **Celeriac** is the most demanding
- A very high demand for irrigation of **Peking cabbage**
 - The crop stays on location for 3 months
- **Leeks** are demanding
- **Peas, spinach** – a short growing period – minimum use of irrigation

Errors in Irrigation

- Late irrigation of onions after 20 July

–Onions need to be let to dry so that necks can constrict and dry out; if onions continue to be irrigated, they develop pulpy necks, start to bolt, and are not storable; they are harvested at the end of July or at the beginning of August – do not irrigate 2 weeks before harvesting to let onions dry out

- Excessive irrigation of celeriac in July and a an untimely end of irrigation at the beginning of September
- Irrigate celeriac evenly, i.e. do not irrigate more heavily in July, for instance
- Celeriac is harvested from the end of September to the beginning of October – stop irrigating 2 weeks before the planned harvest

- **Delayed irrigation of carrots**
 - When carrot roots are the size suitable for consumption, act cautiously – impacted by water, roots crack and secondary growth is induced
- **Little use of irrigation to encourage the stand to come up during a longer dry season**
 - Dry soil at germination – winters used to have a lot of snow – there was sufficient soil moisture in March; nowadays, winters have little snow, there is a lack of moisture in March, and irrigation is needed after sowing
- **Little use of irrigation to increase turgescence of lettuce before harvesting**
 - Irrigate lettuce one day before harvesting to let it absorb water, otherwise, it would fade as early as at the point of harvesting

- Premature irrigation of garlic before the stage of full growth and, vice versa, a late end of irrigation in the middle of June
 - Garlic is harvested in July – do not irrigate at least 2 weeks before harvesting – as soon as the leaves start to bend over, stop irrigating
 - The cultivar ALAN makes an exception – it has to be harvested, as soon as the tips of the leaves start to dry out and not only when the tips start to bend over – at a late harvest, part of the cloves would detach and remain in the soil

- If you start to irrigate **cucumbers**, you have to irrigate them during their whole growing period; or do not irrigate them at all as they are not able to adjust to different conditions and wither
- **Early potatoes and early cole crops** – use non-woven fabric until they start flowering – they grow and prosper without irrigation

Druh zeleniny	Doba závlahy	Požadavky	
		normál. roky	suché roky
Květák raný	1/2 května - 1/2 června	100 - 120	140 - 160
Zelí hlávkové rané	1/2 května - zač. července	80 - 100	120 - 140
Červené zelí rané	1/2 května - 1/2 července	100 - 120	140 - 160
Kapusta hlávková	1/2 května - 1/2 června	80 - 100	120 - 140
Zelí hlávkové stř. rané	zač. července - 1/2 srpna	120 - 140	200 - 220
Zelí hlávkové pozdní	1/2 července - 1/2 září	121 - 140	200 - 220
Kedlubny rané	1/2 května - 1/2 června	60 - 80	100 - 120
Pekingské zelí	1/2 srpna - konec září	100 - 120	160 - 180
Růžičková kapusta	konec července - zač. září	60 - 80	120 - 140
Hlávk. salát raný	zač. května - konec května	80 - 100	100 - 120
Špenát raný	zač. května - 1/2 května	20 - 40	60 - 80
Rajčata	pol. července - konec srpna	80 - 100	160 - 180
Okurky	konec června - 1/2 července	60 - 80	140 - 160
Fazole raná	konec června - konec července	80 - 100	120 - 140
Hrách raný	konec května - 1/2 června	40 - 60	80 - 100
Celer	konec července - 1/2 září	120 - 140	200 - 220
Černý kořen	zač. července - zač. září	100 - 120	180 - 200
Mrkev raná	zač. června - zač. července	80 - 100	120 - 140
Mrkev pozdní	1/2 července - zač. září	100 - 120	180 - 200
Čekanka	konec července - zač. září	60 - 80	100 - 120
Pór	konec června - zač. září	100 - 120	200 - 220
Cibule	1/2 června - 1/2 července	60 - 80	120 - 140
Chřest	1/2 června - 1/2 července	60 - 80	100 - 180

Závlahové schéma J.Morava	Závlahové množství m³/ha	Měsíční množství mm/ha								Počet dávek	
		III	IV	V	VI	VII	VIII	IX	X		
Brukev raná	2500		120	130						8-15	častěji, pravidelná závlaha
Brukev letní	2400			70	100	70				8-15	častěji, pravidelná závlaha
Brukev pozdní	2000					80	100	90		8-10	častěji, pravidelná závlaha
Celer	2900			30	50	50	80	80	30	12-15	hlavně červenec a srpen
Cibule ze semene	300		20	20	30					3	
Cibule ze sazečky	300			20	30					2	
Čekanka salátová	800					40	40			2	výsev je možný i v červnu za předpokladu zajištění závlahy
Červená řepa	1500				30	40	40	40		4	
Fazole lusky	900			30	60					3-4	
Hrách lusky	600			30	60					2	hlavně před nasazením lusků
Kapusta raná	2400		80	120	40					10-12	
Kapusta letní	2600			20	100	80				10-12	
Kapusta pozdní	2000				60	80	60			8-13	
Květák raný	2000		130	130							zavlažovat od výsadby 6 týdnů do zakrytí růžice listy, pak méně
Květák pozdní	2700				150	160	80				
Melouny	1200			30	60	70					od výsevu po nasaz. plodů
Mrkev raná	900			50	40						zavlažovat 6-8 týdnů od vzejití
Mrkev pozdní	800			30	30		40	40			zavlažovat začít 8 týdnů od vzejití
Okurky naklad.	900			40	50						závlaha za květu po nasaz. plodů

Závlahové schéma Jižní Morava	Závlahové množství m³/ha	Měsíční množství mm/ha								Počet dávek	
		III	IV	V	VI	VII	VIII	IX	X		
Okurka salátová	2400			60	90	90				16-12	závlaha za květu po nasazení plodů
Paprika zeleninová	2000			50	60	60				8-12	závlaha za květu po nasazení plodů
Petržel	600					30	30			1-3	jen v období sucha
Pór jarní výsadba	1800					60	70	50		5-8	
Pór lení výsadba	1400						60	60	20	5-6	
Rajčata	1000			40	40	20				5-7	závlaha po nasazení plodů asi do 15.VII.
Ředkvička jarní	800		40	40						5-8	
Ředkvička letní	1000					50	50			5-8	
Salát raný	1300	20	70	40						5-8	zavlažovat častěji před stáčením hlávky, pak omezit
Salát letní	1500				90	60				7-10	
Salát pozdní	1500					40	70	40		7-10	
Salát přezim.	600		30					30		2-3	
Špenát přezim.	600	30							30	2-3	
Špenát jarní	700			40	30					3-4	závlaha 5-10 dní před sklizní
Špenát podzimní	600						30	30		2-3	
Zelí rané	2400		80	100	60					10-12	závlaha hlavně v květu
Zelí letní	2700			80	100	90				10-15	
Zelí pozdní	2500			40	70	70	70			10-15	
Zelí pekingské	1500						40	40	30	8-10	