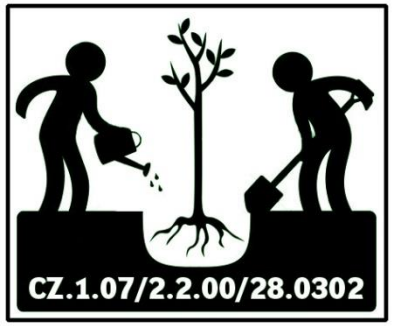
INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ



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

Vegetable Nutrition and Fertilisation

- **Vegetables have high nutrient requirements**
  (in comparison with other crops)
- Nutrition and fertilisation – one of the most important intensification factors, an integral part of cropping techniques
- It is necessary to replenish the nutrients drawn from the soil by means of farm manure and commercial fertilisers – to maintain the soil fertility
- ***The quality of vegetables*** is IMPORTANT:

– The content of desirable components x the content of foreign and undesirable substances (heavy metals, nitrates, etc.)

Factors Influencing Nutrition

Soil Type

- For field vegetables – soils of the highest quality with the depth of the topsoil of 0.4 m and permeable subsoil
- Preferably medium heavy, sandy loam and loam soils, **sufficiently supplied with humus (min. 2-3%)** – these soils are airy, show an intensive biological activity and good conditions for nutrient uptake
- Potentially higher eluviation of nutrients in light sand soils

The Kind of Vegetable Being Grown

- Nutrient consumption in kg per 1 tonne of production (in general, vegetables consume **NPK = 2-1-3**)

Vegetable	N	P_2O_5	K_2O	CaO	MgO
Cabbage	3.57	1.31	4.28	4	0.95
Cauliflower	4	1.6	4.8	2.8	0.5
Kale	3	1.1	3.6	3.4	0.8
Kohlrabi	5	4	7.8	2.8	0.5
Celery	6.5	2.29	10.2	7	2.5
Carrots	4	3.82	8	5.6	1.66
Parsley	2.2	0.92	4.8	1.4	1.33
Cucumbers	1.67	1.53	2.88	0.94	0.83
Tomatoes	2.75	0.87	3.6	3.15	0.42
Peppers	2.75	0.87	3.6	3.15	0.42
Onions	2.67	1.53	4	2.34	1.11
Garlic	2.8	1.14	5.64	2.38	0.5
Lettuce	2.2	0.92	4.8	1.12	0.4
Spinach	4.75	1.72	4.8	1.4	1.58
Snap beans	9.2	2.52	7.2	9.1	1.66
Peas	8	2.52	7.92	6	1.66

P is present in soils in a sufficient amount, K and N are principally needed (large use of K)

Length of the Growing Period

- The nutrient intake changes during the growing period
  - The maximum need of nutrients is at 2 1/3 of the growing period
- The shorter the growing period (especially early varieties)
  - The more available nutrients in the soil the plant needs and vice versa
- The microbial activity is restricted at lower temperatures in the spring and a small amount of nutrients is released by mineralisation
  - Especially N
- In the case of **vegetables with a short growing period** the main nutrient dose is needed before sowing / planting
- **Vegetables with a longer growing period** favour further fertilising during the growing period

Climate Conditions

- A low soil **temperature** limits the uptake of N and P (weak mineralisation)
- **Water** – in a dry season plants suffer nutrient deficiencies
- **Lighting intensity**

– Intense sunshine has a positive effect on the uptake of N, P, and S

– Shading allows a greater absorption of K

Soil Properties

- Optimum levels of available nutrients – a change in pH causes a change in the solubility of microelements and the phosphorus availability
- The pH value affects the composition of the soil microflora and the nutrient availability
- With an increased concentration of salts (over-fertilisation, Na) in the soil solution the osmotic potential increases and the nutrient uptake is reduced
- The optimum pH for vegetables to grow and develop is between **pH 6.0-7.5**
  - It is essential to determine pH before sowing, some vegetables (lettuce at 4.5) stop growing at a lower pH

- **Good tolerance of liming:** leguminous plants, onions, carrots, cole crops, root vegetables – application in the autumn (ground limestone, dolomitic limestone (Mg), granulated limestone and suchlike)

- **Liming does not benefit:** cucumbers, tomatoes, celery (the preceding crop is limed)

Soil pH Requirements of Vegetables

Vegetable	pH requirement	Vegetable	pH requirement
Cabbage	6.3 – 7.8	Celery	6.5 – 7.5
Cauliflower	6.4 – 7.5	Tomatoes	5.5 – 7.0
Kale	6.4 – 7.3	Peppers	6.0 – 7.0
Kohlrabi	6.0 – 7.3	Cucumbers	6.6 – 7.2
Onions	6.5 – 7.8	Lettuce	6.2 – 7.5
Garlic	6.0 – 6.5	Spinach	6.0 – 7.5
Carrots	6.7 – 7.5	Peas	6.6 – 7.7
Parsley	6.5 – 7.5	Beans	6.5 – 7.8

Manuring

- The volume of the organic matter applied depends on:
  - Its availability (there are no livestock)
  - The soil type
  - The percentage of crops that enrich and impoverish the soil with regard to organic substances

- Having the content of **humus of 2-4%,** soils show a good biological activity, are airy enough and when irrigated, they provide vegetables with an optimum environment
  - Good capability of water and nutrient sorption

- Basic organic fertiliser – **aged stable manure**
- Other fertilisers: farm yard and commercial composts, green manure, N-enriched straw

- Recommended optimum amounts for individual vegetables (literature):
  - **50 t/ha** cabbage, cauliflower, kale, celery
  - **35 t/ha** kohlrabi, cucumbers, tomatoes, peppers, leeks

- The reality is different – a satisfying result is the application of half the amount

- Very useful – **green manure**
  - Hinders water and wind erosion, suppresses weeds, and by shading, it keeps water from evaporating
  - Sowing crops <u>after the vegetable harvest at the end of the summer</u>: **<u>tansy phacelia</u>**, **<u>field peas</u>**, **<u>vetch</u>**, mustard (BRASSICAS – DISEASE)

  - Many vegetables enrich the soil with organic matter:
  - Half the weight is used as market goods
  - $^{1}/_{3}$ – ½ ... waste (Peking cabbage, cole crops) which goes into the soil, enriching it

(Lettuce, green peas, beans, peas, tomatoes
cabbage – processing line in the field – leaves fall back down on the field ground)

– It is a drawback of a crop rotation if cole crops are succeeded by a brassica mixture – a risk of crown gall

- 50% of the crops grown are cole crops (brassicas) – it is not desirable to increase the number by adding mustard – crown gall is spreading countrywide

- Commercial composts for fertilisation
  - in both the autumn and the summer, they do not have to be applied to the soil

Mineral Fertilisation

N Fertilisation

- Key role in the plant metabolism
- The most significant effect on the **volume** of plant production if the supply of other nutrients is balanced as well as on the **quality**
- Decisive **element in growth, yield and quality**
- N is present in soil in the organic form N_{org}(98-99%) which is not available to plants and only a small amount of N is present in the mineral form N_{min}
- To specify basic fertilisation, the levels of N_{min} in the soil (ammonium + nitrate nitrogen) are determined
- **The amount of N** is determined according to the plant's requirement on N and the estimated yield, and an ***adjustment*** follows with respect to manuring, the preceding crop and the N_{min} present in the soil

N Deficiency

- Plants show poor growth (poor root growth)
- Leaves are small, narrow in shape, pale green to yellow, occasionally orange to red
- In the case of cole crops – **grey-green leaf colouring**
- Lettuce, cabbage, and kale **form heads with difficulty**
- Beetroot and red cabbage acquire intense red colour
- The deficiency is mainly displayed on older leaves – they gradually turn brown and die off

N Surplus

- Spongy tissues
- Lower content of dry matter
- Proneness to fungal diseases
- Limited storability

NITROGEN (N)

High demanding:

- Cauliflower, Peking cabbage, savoy cabbage, cabbage, pumpkins, horseradish, leeks, rhubarb, celery

Medium demanding:

- Savoy, kohlrabi, cucumbers, lettuce, carrots, parsley, parsnips, radishes, garden beetroot, spinach, tomatoes, onions

Low demanding:

- Beans, peas, small radishes

- Why does the small radish have a low N demand?
  - Because its growing period is 6 weeks and there is always some nitrogen present in the soil

- The beetroot accumulates nitrates! N harms the storability
  - Any root vegetable that is over-fertilised with N – its storability is reduced
  - Up to 100 kg of N per 1 ha is more than enough for root vegetables

METHOD OF NITROGEN FERTILISATION OF INDIVIDUAL VEGETABLE GROUPS

LETTUCE, SPINACH, SMALL RADISHES, BEETROOT, EARLY KOHLRABI:

- One-off fertilisation before sowing, planting

CABBAGE, KALE, LATE KOHLRABI

CAULIFLOWER, TOMATOES, PEPPERS, CUCUMBERS:

- 20% of the total amount is applied only after planting, 30 days after it

CARROTS, PARSLEY, CELERY:

- 20% of the total amount is applied 30 days after coming up and planting

ONIONS, SPRING GARLIC:

- 30% of the total amount is applied 30 days after coming up

WINTER GARLIC:

- 30-40% of the total amount is applied early in the spring

LATE CAULIFLOWER

- 20% 20 days after planting
- 20% 40 days after planting

of the total amount

N Fertilisers

- **BASIC FERTILISATION:**

– **Ammonium sulphate**, **urea**,

lime nitrogen (bacterial club root) with cole crops

- **SIDEDRESSING:**
  - **Ammonium nitrate with limestone**
  - With vegetables with a short growing period – **calcium nitrate**
    - **Calcium nitrate** is not recommended for soils with pH > 7.2, the reason being its increasing of alkalinity

- **The nitrate form**
  - With vegetables with a short growing period at the initial growth stage
  - For fertilisation during the growing period
    (topdressing with carrots, kale, spinach, beetroot)
  - On acidic soils

- **The ammonium form**
  - Nitrogen is well bound, a lower risk of its leaching
  - Required by celery, cucumbers, tomatoes, and onions
  - For vegetables with a longer growing period
  - At plant germination, larger amounts of ammonium nitrogen have a toxic effect
  - Urea is also suitable for topdressing

- Very good results when fertilisers with both the N forms used

P Fertilisation

- Main nutrient improving the soil physical state
  - Nutrition of microorganisms
- It encourages root growth – it affects the production of humus from root residues
- The availability of P is increased by the soil temperature (growing in a greenhouse) and lighting
- Especially vegetables with shallow root system (lettuce, peppers) require a sufficient supply of available phosphorus

- Determining the total amount of P is based on the P consumption to produce the yield and on the reserve of this element in the soil

- An adjustment of the total amount is made according to farm manure and the available P levels in the soil

- **When low P levels in the soil, growing vegetables is not recommended**, P fertilisation is not used at a sufficient soil reserve

P Deficiency

- Vegetables with high demand for P, especially at an early development stage

- Growth depression:
  - Reduced growth of stems, roots, and side shoots
  - In the case of tomatoes, the first two leaves form an obtuse angle

- Reddish colouring of the underside of leaves

PHOSPHORUS (P)

High demanding:

- Cauliflower, beans, cucumbers, carrots, savoy cabbage, cabbage

Medium demanding:

- Peas, kohlrabi, lettuce, parsnips, parsley, leeks, celery, Brussels sprouts, horseradish, tomatoes, onions

Low demanding:

- Small radishes, radishes, beetroot, savoy

P Fertilisers

- **Amofos**, **PK sol, superphosphate**
  - If necessary, immediately increase the amount of P in the soil
  - Modern mixed fertilisers

- **Ground phosphate**
  - Less suitable for the phosphorus form that is available with difficulty
  - only where there is a sufficient reserve in the soil

- It is good to **fertilise with superphosphate** before sowing or planting – autumn reserve fertilisation has not proved effective
  - **With vegetables, a great utilisation of P comes rather directly from commercial fertilisers than from the soil reserve (!)**

- Reserve P fertilisation is to combine with farm manure

K Fertilisation

- K increases the levels of sugar, starch, cellulose, and vitamins
- **It extends storability**
- **Plants are more resistant to disease**
- It affects the growth, yield, and the **quality** of the vegetables grown

➢ **In the spring,** vegetables draw K from the soil,

➢ **But in the summer,** this supply is insufficient – it is desirable to use additional commercial fertilisers

- The yields of **green vegetables and celery** **are** positively influenced by **Cl** forms of K fertilisers (potassium chloride KCl)

- The yields of **root and fruit bearing vegetables** are reduced by **Cl** forms

- Larger amounts of **chlorides** increase the soil solution concentration (reduced availability of water and nutrients)

- Determining the **amount of K** is based on the consumption of 1 tonne of production, an adjustment conducted according to farm manure and the K reserve in the soil

K Deficiency

- Pale green colouring of leaves, delayed growth
- Cauliflower – leaf curl
- Lettuce forms heads with difficulty, curled leaves
- **Necrosis** spreading from the leaf edges
- Reduced resistance to low temperatures
- Poorer utilisation of water

POTASSIUM (K)

High demanding:

- Cauliflower, beans, peas, rhubarb, parsnips, spinach

Medium demanding:

- Cucumbers, tomatoes, peppers, carrots, celery, radishes, horseradish, cabbage, onions, garlic

Low demanding:

- Savoy, parsley, leeks, small radishes, beetroot
  - **Stored vegetables need a sufficient amount of K** to allow proper tissue maturing and adequate, long storage
  - Savoy is a low demanding plant – it is aftercultivated and not stored

K Fertilisers

- **Potassium sulphate**
  - For **fruit bearing** vegetables and **onion** vegetables

- **60% potassium chloride**
  - For **other vegetables**, due to a lower chlorine content
  - 40% KCl is the least suitable

Mg Fertilisation

- Vegetables have a **high demand for magnesium**
- In the case of its deficiency – leaf chlorosis and necrosis
- Older leaves are struck first
- Cole crops – leaf mottling
- Tomatoes in greenhouses are sensitive to its deficiency
- **A deficiency shows on acidic soils,**
- liming encourages the uptake of Mg
- Amount: the estimated yield and the consumption of 1 t of
- production, an adjustment according to the available Mg levels
- in the soil and the **ratio K:Mg**

Value of K : Mg	Ratio assessment
Up to 1.6	Good
1.6 – 3.2	Satisfactory
Above 3.2	Unsatisfactory (do not fertilise with K)

Mg Fertilisers

• Kieserit	15% Mg	
• Dolomitic limestone	9% Mg	
➢ When the reserve in the soil is small	30 kg	Mg/ha
➢ When the reserve is medium	15 kg	Mg/ha
➢ When the reserve is sufficient	up to 8 kg	Mg/ha

Ca Fertilisers

• Liming used in the autumn if necessary – the soil pH

– **Carbonate** form:

- **Ground and dolomitic limestone**
- **Sugar press mud** (absence of sugar factories)

– Not suitable:

• Fertilisers in the form of **oxides**: **burnt and ground lime**

-They harm the microbial life in the soil

Fertilisation Requirements of Vegetables

CELERIAC

- Stable manure (++)
- Demand for humus (++)
- It tolerates the chloride form of fertilisers (readily 40% KCl) (+)
- pH 6.5 – 7.2

- **Over-fertilisation with N:** hollow tubers, longer cooking time, blue to black pulp (not looking good in soups)

- **N deficiency:** the pulp lignifies and becomes coarser, a higher content of cellulose

- It needs Ca, K, B, and a small amount of Cu and Mn

ONIONS

- Does not tolerate stable manure (–)
- Does not tolerate liquid manure (–)
- **N surplus**
  - Onions bolt – large percentage of bolters
  - Pungent taste
  - Absence of storability – risky, bolters spreading among healthy onions infect these onions – the neck is not closed
- pH 6.5 – 7.0
- They require a sufficient amount of Ca, K, S (production of essential oils), Cu, Zn, Mn
- Sulphate forms of K fertilisers (+)
- Chloride forms of K fertilisers (–)
  (Leaf tip yellowing that prematurely ends the growing period)

WITLOOF CHICORY

- Stable manure (+)
- Demand for humus (++)
- Heavy or medium feeders
- Avoid over-fertilisation with N
- pH 6.4 – 7.0, pH 5.8 – 6.4 on lighter soils

- Optimum roots are those of medium size (the diameter of the crown of the root of **3-6 cm** – when roots are too thick, they do not form nice chicons)

- Additional topdressing done with 30-40 kg/ha of N as necessary

BLACK SALSIFY

- Stable manure (–)
- The nitrate form of fertilisers (–)

- At **N surplus:** hollow, spongy, bitterish, inedible roots, the start to bolt

- pH 6.8 – 7.2
- Cu+

GARLIC

- **Over-fertilisation with N** – the quality and storability are reduced
- pH 6.0 – 7.0
- Potassium sulphate and ammonium sulphate reserve fertilisation
- Cu+, Zn+, Mn+

PEAS

- Stable manure (–)
- A sufficient amount of P, Mo++, Mn++
- pH 5.0 – 7.5 (not a pH below 5 !)

ASPARAGUS

- Lighter, humus-rich, heat-retaining soils
- 30-40 t/ha of stable manure every 3 to 4 years

  – The crop stays on location for 10-12 years

  – Manuring at 3 to 4-year intervals

  – Loess and light heat-retaining soils are optimum – they contain humus

SAVOY CABBAGE

- A sufficient amount of humus (+)
- Stable manure (+)
- Excrements (–) (cause turning bitter)
- B++, Cu+, Mo+, Mn+
- pH 7.0 – 7.2
- Storability is the priority (less N)

BRUSSELS SPROUTS

- They require an alkaline soil reaction – **pH 7.2 – 8.0**
  - Difficulty in maintaining an alkaline soil reaction
  - Grown in the potato growing area – the soils there are acidic – need of liming

- B++, Cu+, Mo+, Mn+

KOHLRABI

- A sufficient content of humus in the soil (+)
- Direct stable manure fertilisation (–) (tuber cracking)
- B++, Cu+, Mn+

HORSERADISH

- Adequate manuring (+) (perennial horseradish – 10 years)
- Manuring once in 3-4 years

- A sufficient amount of Ca, K

- It does not tolerate **acidic soils** – it turns black after being grated
- Pure white only on neutral soils

CAULIFLOWER

- A high content of **humus** in the soil (++)
- It has a very high demand for **K** (++)
- **K, Mn, and Mg** deficiencies cause a poor quality of curds – thinning, acquiring a moss-like structure (the curd collapses and exhibits a green-brown film)
- **Mo** deficiency: whiptail
  (also the swede midge – it eats up the growing point)
  - **Spraying of the planting stock with** 0.1% ammonium molybdate or sodium molybdate
- **B** deficiency: curd rotting
  - **Spraying of the planting stock with** 0.1% sodium borate
- Need of supplying magnesium Mg 15-30 kg/ha

AUBERGINE

- A high content of humus in the soil
- Additional fertilisation with K and P
- It is practically not grown, being more demanding than peppers

- It should be eaten 2-3 times in a year as it degrades bad cholesterol

MELON

- Stable manure (+)
- A sufficient amount of K

CARROTS

- They do not tolerate acidic soils and direct manure and liquid manure fertilisation
- N surplus: root cracking, poor storability
- A sufficient amount of Ca, K, Cu++

CUCUMBERS

- They need **manuring (++) 15 cm deep**

  (they produce rather wide roots)

- Very sensitive to **Cl** – instantaneous chlorosis, leaf margin browning, plant yellowing

- An adequate fertiliser is Kainit (K fertiliser without Cl)

- **The sulphate form of N and K fertilisers is adequate**

  – The nitrate form of N induces a higher production of male flowers

  – and low fertility and hollow fruits

- K deficiency encourages fruit deformation – the fruits are constricted and unsightly

- Mn++

PEPPERS

- They have a very high demand (++) for humus

- They require a sufficient amount of K and P
- Very sensitive to **Cl** – chlorosis

- N surplus – low number of pods
- N deficiency – poorer quality
- N rather in the **ammonium** form

- Cu++

PARSNIPS

- **pH 7.0 – 7.4** – problem – they are produced in potato production areas

- Cu+

LEEKS

- Stable manure (++)
- pH 7.0 – 7.8
- A robust root system, elaborate nutrient suction, need of intensive fertilisation and irrigation

- Mg + (determine its levels in the soil)
- Mn+

TOMATOES

- Sensitive to P deficiency at germination

- An increased need for K, B
- Very sensitive to chlorine **Cl** (!)

- N surplus: encouraging watery fruits and tops growth
- Rather the **ammonium form of N**

- Cu+, B, Mo, Zn, Mg

RHUBARB

- A great demand for humus and Ca

- It is adequate to sidedress with **liquid manure (++)** (the only vegetable) after the harvest in the middle of July
  - It is vital to let rhubarb flower, otherwise it dies

BEANS

- Stable manure (–)
- At N surplus they produce a small number of pods
- They have a high demand for a sufficient amount of Ca, P, Zn+

RADISHES, SMALL RADISHES

- **N surplus**: hollowness – forming cavities in roots

- They require a sufficient amount of Mg+, B+, Mn++, Cu+

GARDEN-BEETS

- Direct **manure fertilisation is not desirable** (the priority is smaller tubers of butyraceous consistence, N causes fibre to be coarse, colour to be unsatisfactory, and it accumulates nitrates)

- The norm of **3,500 mg N/kg**, it is all right to have even 11,000 mg N/kg

- They require a sufficient amount of K, P, Cu, B, Mn

HEAD LETTUCE

- It grows **even if not fertilised with manure**, a short growing period
- An increased demand for P, B

- It does not tolerate an acid soil reaction below pH 5.5 (optimum pH 5.8 – 6.5)

- Very sensitive to excessive levels of salt in the soil
- Magnesium – Kieserit
- Cu^{+}, Mn^{+}

SPINACH

- It has a high demand for **K**, Kainit is very adequate (K+Mg)
- **Avoid over-fertilising with N** – cumulation of nitrates, the norm of 2,000 mg
- Ca deficiency: bitterish, yellowish leaves
- A sufficient amount of Ca, Na, B, Cu, Mn

CABBAGE

- Use **manure** fertilisation especially with processing cabbage
- Manure is not much needed with storage cabbage

- Mg where there is no magnesium in the soil– fertilise with 30-50 kg/ha of Mg
  – It can decrease the yield by ?

- pH 6.5 – 7.0
- B^{++}, Cu^{+}, Zn^{+}, Mn^{+}

N Fertilisation (kg/ha)

Crop	X		Manured	
	Heavy soil	Light soil	Heavy soil	Light soil
Cabbage, cauliflower	190	210	160	180
Savoy cabbage and Brussels sprouts	160	180	130	150
Kohlrabi	110	130	90	110

Kohlrabi treated with one-off fertilisation before planting
Cauliflower 20% 20 days after planting, 20% 40 days after planting
Cabbage, kale 20% 30 days after planting

Amounts of N (N kg/ha) in the Standard Groups

Crop	Basic standards before 1990			Decreased standards			Progressively decreased standards		
	B	D	F	B	D	F	B	D	F
Cabbage and cauliflower **	220	230	240	190	200	210	160	170	180
Savoy cabbage and Brussels sprouts **	190	200	210	160	170	180	130	140	150
Kohlrabi *	1360	140	150	110	120	130	90	100	110
Onions	140	150	160	120	130	140	90	100	110
Garlic	80	90	100	60	70	80	30	40	50
Carrots and parsley	70	80	90	50	60	70	20	30	40
Celery **	150	160	170	120	130	140	90	100	110
Beetroot	110	120	130	90	100	110	60	70	80
Small radishes	40	50	60	20	30	40	-	-	-
Cucumbers *	190	200	-	170	180	-	150	160	-
Tomatoes and peppers *	150	160	-	130	140	-	110	120	-
Lettuce and spinach	50	60	70	30	40	50	-	-	-

B Warm area with medium-heavy to heavy soils with a zero percolation rate
D Medium-warm area with loam and sandy loam soils with medium percolation rates
F Colder area, harder conditions, lighter, gravel soils with high percolation rates
*manuring ** 50 t/ha, * 35 t/ha
The highlighted figures represent the most frequent cases corresponding with a rational alternation of crops within a crop rotation.

HODNOCENÍ OBSAHU PŘÍSTUPNÉHO FOSFORU V ORNÉ PŮDĚ

OBSAH	mg. P. 1000 g ZEMINY
VELMI MALÝ	do 15
MALÝ	16 - 30
STŘEDNÍ	31 - 65
DOBRÝ	66 - 80
VYSOKÝ	nad 80

P_2O_5 Amount Standards for Individual Vegetable Groups according to the Levels of Available P in the Soil (Polách, 1985)

Crop	The amount of P_2O_5 in kg/ha when the P levels in the soil are				
	Very low	Low	Medium	Good	High
Cabbage, cauliflower, kale, tomatoes, peppers	125	165	**75**	55	29
Onions, garlic, leeks, carrots, celery, parsley, beetroot	125	116	**55**	36	18
Small radishes, lettuce, spinach	125	83	**46**	27	18
Cucumbers	180	125	**126**	90	45

HODNOCENÍ OBSAHU PŘÍSTUPNÉHO DRASLÍKU V ORNÉ PŮDĚ

OBSAH	mg. K. 1000 g ZEMINY		
	LEHKÁ	STŘEDNÍ	TĚŽKÁ
VELMI MALÝ	do 50	do 70	do 90
MALÝ	51-80	71-110	91-140
STŘEDNÍ	81-130	111-170	141-220
DOBRÝ	131-200	171-250	221-330
VYSOKÝ	nad 200	nad 250	nad 330

Normativy dávek K_2O k jednotlivým skupinám zeleniny podle obsahu přístupného K v půdě (Polách, 1985)

Plodina	Dávka K_2O v kg/ha při obsahu v půdě				
	velmi malém	malém	středním	dobrém	vysokém
Zelí, kapusta, cibule, česnek, mrkev, petržel	300	170	**120**	85	40
Květák, okurky, rajčata, paprika, celer	300	190	**145**	100	50
Pór, červená řepa	300	140	**100**	60	30
Ředkvička, salát, špenát	300	120	**85**	50	25