



Phosphorus deficiency symptoms in plants

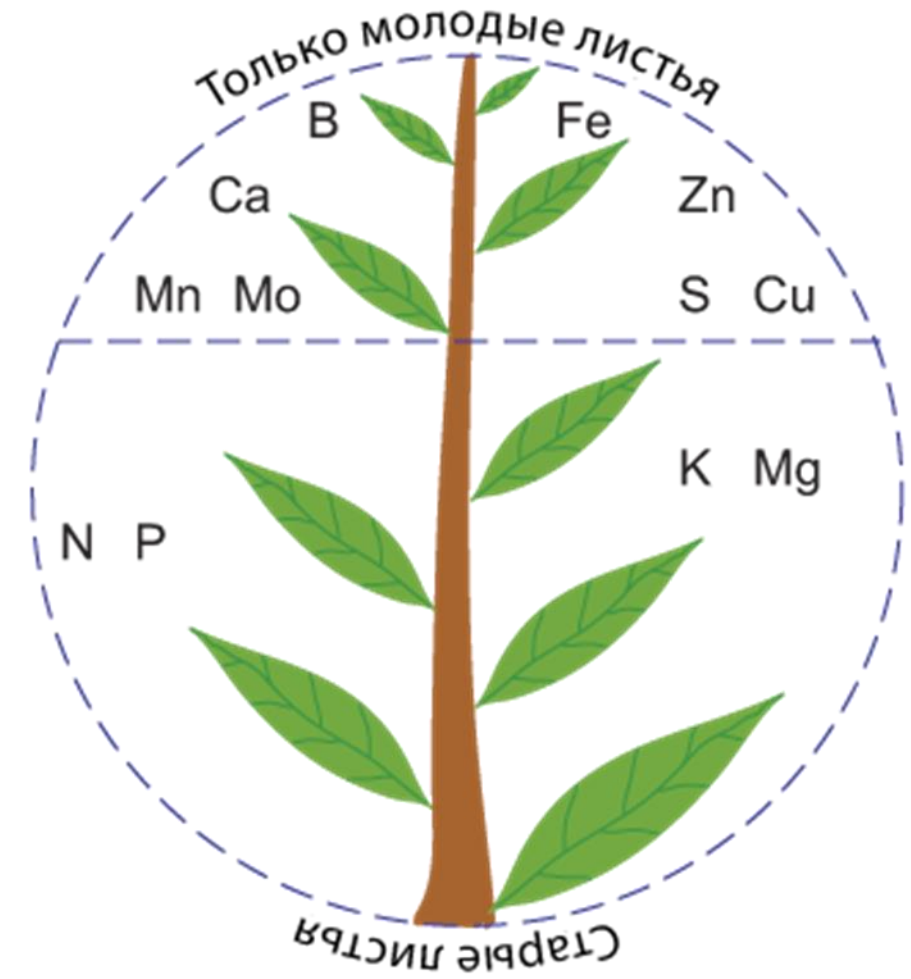
Vladimir Nosov

PhD (Soil Science), Competence Centre
Head, Apatit, PhosAgro Group
vnosov@phosagro.ru



Phosphorus deficiency symptoms in plants

- The first symptom is inhibited plant growth.
- If that is the case, leaf blades may turn dark green and lose their shape.
- If the deficiency is severe, spots of dead tissue can appear on the leaves, stems and fruit.
- The older leaves are affected first, with the younger ones following suit later on as phosphorus is reutilised in the plant.
- Some crops see their bottom leaves and lower part of the stem turn purple or reddish.
- This colouration is due to the accumulation of sugars in plants with phosphorus deficiency, especially at low temperatures, which are conducive to the synthesis of anthocyanin pigments.





Colour change in phosphorus deficiency

Red (reddish-purple) leaf edges	Red (reddish-purple) other parts of leaves	Leaves without colour change or dark green
Maize Rapeseed Lentil Apple tree Pear tree Strawberry Grape	White cabbage Tomato	Soybeans Onion Sugar beet Rice

Phosphorus deficiency symptoms in wheat



The reddish-purple colouring spreads from the top down, affecting the entire width of the leaf.

IPNI Crop Nutrient Deficiency Image Collection, 2019



Phosphorus deficiency symptoms in winter wheat



In leached chernozem soil with a high labile phosphorus content, 30 kg of P_2O_5 / ha was applied by broadcasting in the autumn.

Foliar application of phosphorus at a dose of **11 kg/ha of P_2O_5 \approx 21 l/ha of Apaliqua® APP NP 11-37** helped remedy the situation.



Phosphorus deficiency symptoms in wheat

Delayed ripening in case of phosphorus deficiency



With sufficient phosphorus nutrition, only a few days are left until physiological ripeness

IPNI Crop Nutrient Deficiency Image Collection, 2019



Phosphorus deficiency symptoms in maize



P deficiency in the middle of the summer.

Labile P content in the soil =
11.9 mg of P_2O_5 / kg (Olsen P).

IPNI Crop Nutrient Deficiency
Image Collection, 2019

Phosphorus deficiency symptoms in rapeseed



IPNI Crop Nutrient Deficiency
Image Collection, 2019



Phosphorus deficiency symptoms in sorghum



Purple colouring of old leaves.

IPNI Crop Nutrient Deficiency
Image Collection, 2019



Phosphorus deficiency symptoms in chickpea



Inceptisol (young soil with poorly developed horizons) with low humus content (0.3%) and low labile phosphorus reserves (21.1 kg of P_2O_5 / ha).

Plants showing symptoms of deficiency had a leaf phosphorus content of 0.12–0.15% (P).

IPNI Crop Nutrient Deficiency
Image Collection, 2019



Phosphorus deficiency symptoms in potato



External symptoms on potato leaves and stems appeared very quickly on soils with a low supply of available forms of P.

This variety (Asterix) was the most sensitive to P deficiency among all the varieties studied.

IPNI Crop Nutrient Deficiency
Image Collection, 2019



Phosphorus deficiency symptoms in white cabbage



Acid soil with a low labile P content.

IPNI Crop Nutrient Deficiency
Image Collection, 2019



Phosphorus deficiency symptoms in red beet



The sowing was carried out on the same day.

When P was excluded from the nutrient solution, the following was observed:

- intense reddish-purple colouring of the roots and leaves;
- slower growth of the plants;
- cessation of root growth.

IPNI Crop Nutrient Deficiency Image Collection, 2019



Phosphorus deficiency symptoms in soybean



Stunted growth.



Optimum N, P and K content in plants

Crop	Growth phase	Part of the plant	N	P	K
			% (absolute dry matter)		
Maize	Seedlings (< 10 cm)	Whole plant	4.00–5.00	0.40–0.60	3.00–4.00
	Vegetative	Uppermost fully expanded leaf	3.00–4.00	0.30–0.50	2.00–3.00
	Tassel emergence	Ear leaf	2.80–4.00	0.25–0.50	1.80–3.00
Soybeans	Germination	Uppermost fully expanded trifoliolate leaf	3.50–5.50	0.30–0.60	1.07–2.50
	Flowering	Uppermost fully expanded trifoliolate leaf	3.25–5.00	0.30–0.60	1.50–2.25
Wheat, barley, rye and oats	Seedlings (before stem elongation)	Whole plant	4.00–5.00	0.20–0.50	2.50–5.00
	Flowering	Flag leaf	4.00–5.00	0.20–0.50	2.00–4.00
Sorghum grain	Seedlings (< 30 cm)	Whole plant	3.90–5.00	0.20–0.50	2.00–4.00
	Vegetative	Uppermost fully expanded leaf	3.00–4.00	0.20–0.40	2.00–4.00
	Flowering	Flag leaf	2.50–4.00	0.20–0.35	1.40–4.00
Alfalfa	Number of flowers on 10% of stems \geq 1	Upper parts – 10–15 cm (leaves and stems)	3.00–5.00	0.25–0.70	2.00–3.50
Red feather clover	Before flowering	Upper parts – 10–15 cm (leaves and stems)	3.00–4.50	0.20–0.60	2.20–3.00
Cock's-foot	Five weeks after cutting or renewed vegetative development in spring	Whole plant	2.50–3.50	0.25–0.35	2.50–3.50
Sugar beet	Middle of the vegetative phase	Central fully expanded leaf	3.01–4.50	0.26–0.50	2.01–6.00
Vegetables	–	Uppermost fully expanded leaves	2.50–4.00	0.25–0.80	2.00–9.00
Potato	Middle of the vegetative phase	Petioles of the uppermost fully expanded leaf	2.50–4.00	0.18–0.22	6.00–9.00

Schwab et al, 2007; Vitosh et al, 1994



Thank you!