



# Results of field trials with phosphate fertilizers

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# Application of P fertilisers for winter wheat

No.	Trial option	Fertilizer	Physical weight, kg/ha	Application method
1	N <sub>180</sub> P <sub>60</sub>	Diammonium phosphate (DAP) Apaviva® NP 18-46	130	Broadcasting for pre-sowing treatment
		Urea Nitriva® N 46.2	54	Broadcasting for pre-sowing treatment
			144	Extra nutrition by broadcasting (tillering)
			144	Extra nutrition by broadcasting (late tillering)
2	N <sub>180</sub> P <sub>60</sub> S <sub>36</sub>	Sulphoammophos Apaviva® NP(S) 16-20(12)	300	Broadcasting for pre-sowing treatment
		Urea Nitriva® N 46.2	144	Extra nutrition by broadcasting (tillering)
			144	Extra nutrition by broadcasting (late tillering)
3	N <sub>180</sub> P <sub>80</sub>	Diammonium phosphate (DAP) Apaviva® NP 18-46	174	Broadcasting for pre-sowing treatment
		Urea Nitriva® N 46.2	162	Extra nutrition by broadcasting (tillering)
			162	Extra nutrition by broadcasting (late tillering)
4	N <sub>180</sub> P <sub>80</sub> S <sub>48</sub>	Sulphoammophos Apaviva® NP(S) 16-20(12)	400	Broadcasting for pre-sowing treatment
		Urea Nitriva® N 46.2	127	Extra nutrition by broadcasting (tillering)
			127	Extra nutrition by broadcasting (late tillering)
5	N <sub>180</sub> P <sub>100</sub>	Diammonium phosphate (DAP) Apaviva® NP 18-46	217	Broadcasting for pre-sowing treatment
		Urea Nitriva® N 46.2	154	Extra nutrition by broadcasting (tillering)
			154	Extra nutrition by broadcasting (late tillering)

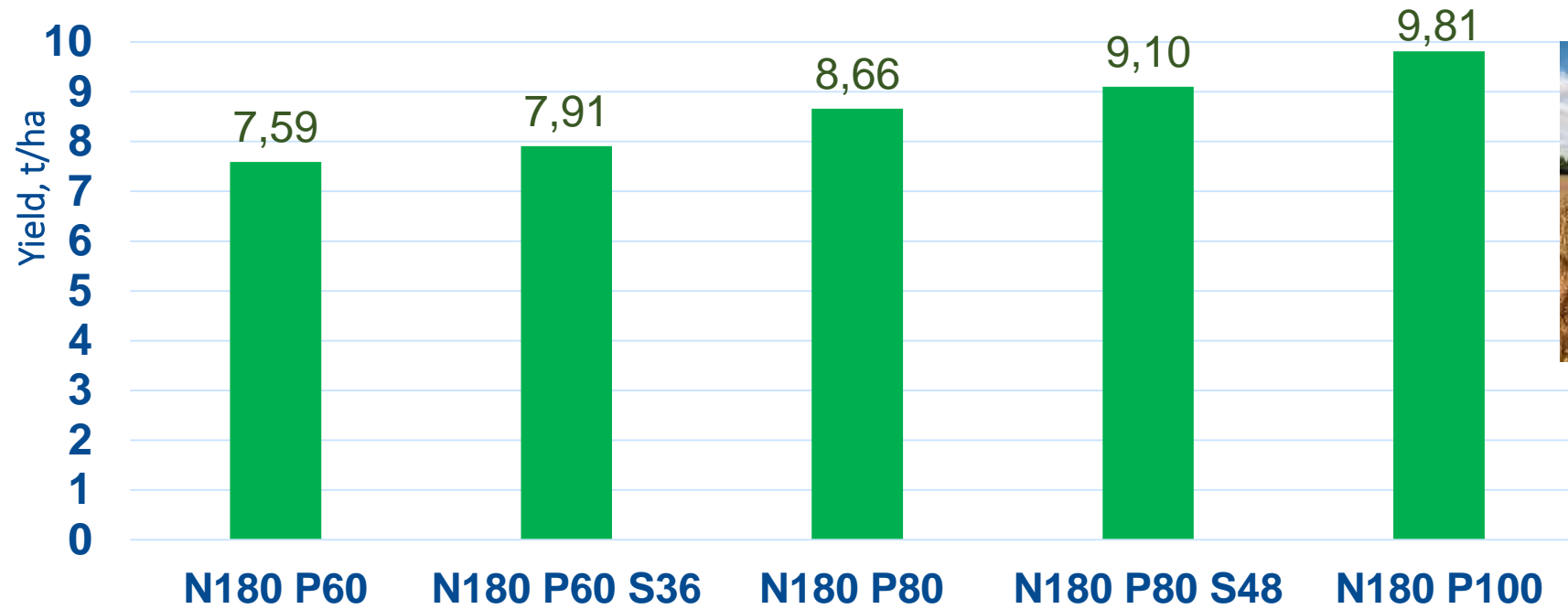
Initial content of labile nutrients in soil:

P – very low, K – high, S – low. N<sub>min</sub> spring concentrations in soil at 0–60 cm: 32–69 kg/ha.

Serbia, 2022



# Winter wheat grain yield



Apaviva® NP 18-46

Apaviva® NP(S) 16-20(12)

Apaviva® NP 18-46

Apaviva® NP(S) 16-20(12)

Apaviva® NP 18-46

Honestly significant difference (HSD)<sub>05</sub> = 0.15

Serbia, 2022



# Application of P fertilisers for silage maize

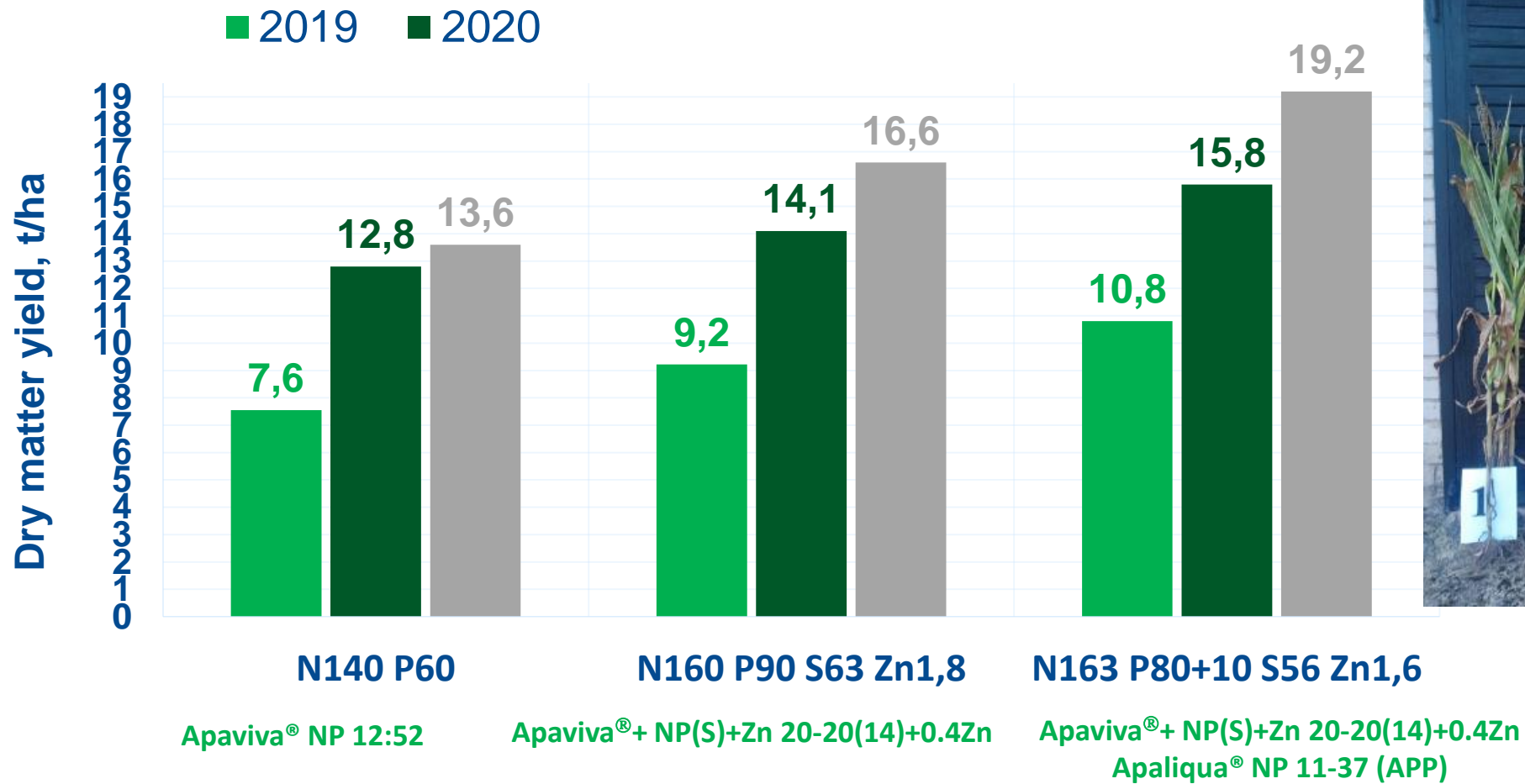
No.	Trial option	Fertilizer	Physical weight, kg/ha	Application method
1	N <sub>140</sub> P <sub>60</sub>	Monoammonium phosphate (MAP) Apaviva® NP 12-52	115	Broadcasting for pre-sowing treatment
		Urea Nitriva® N 46.2	272	
2	N <sub>160</sub> P <sub>90</sub> S <sub>63</sub> Zn <sub>1.8</sub>	Apaviva®+ NP(S)+Zn 20-20(14)+0.4Zn	450	Broadcasting for pre-sowing treatment
		Urea Nitriva® N 46.2	152	
3	N <sub>163</sub> P <sub>80+10</sub> S <sub>56</sub> Zn <sub>1.6</sub>	Apaviva®+ NP(S)+Zn 20-20(14)+0.4Zn	400	Broadcasting for pre-sowing treatment
		Urea Nitriva® N 46.2	174	
		Apaliqua® NP 11-37 (APP)	27	Foliar application (for plants of 15 cm in height)

**Initial content of labile nutrients in soil:**  
P – medium to good, K – high.

Lithuania, 2019–2020



# Silage maize dry matter yield

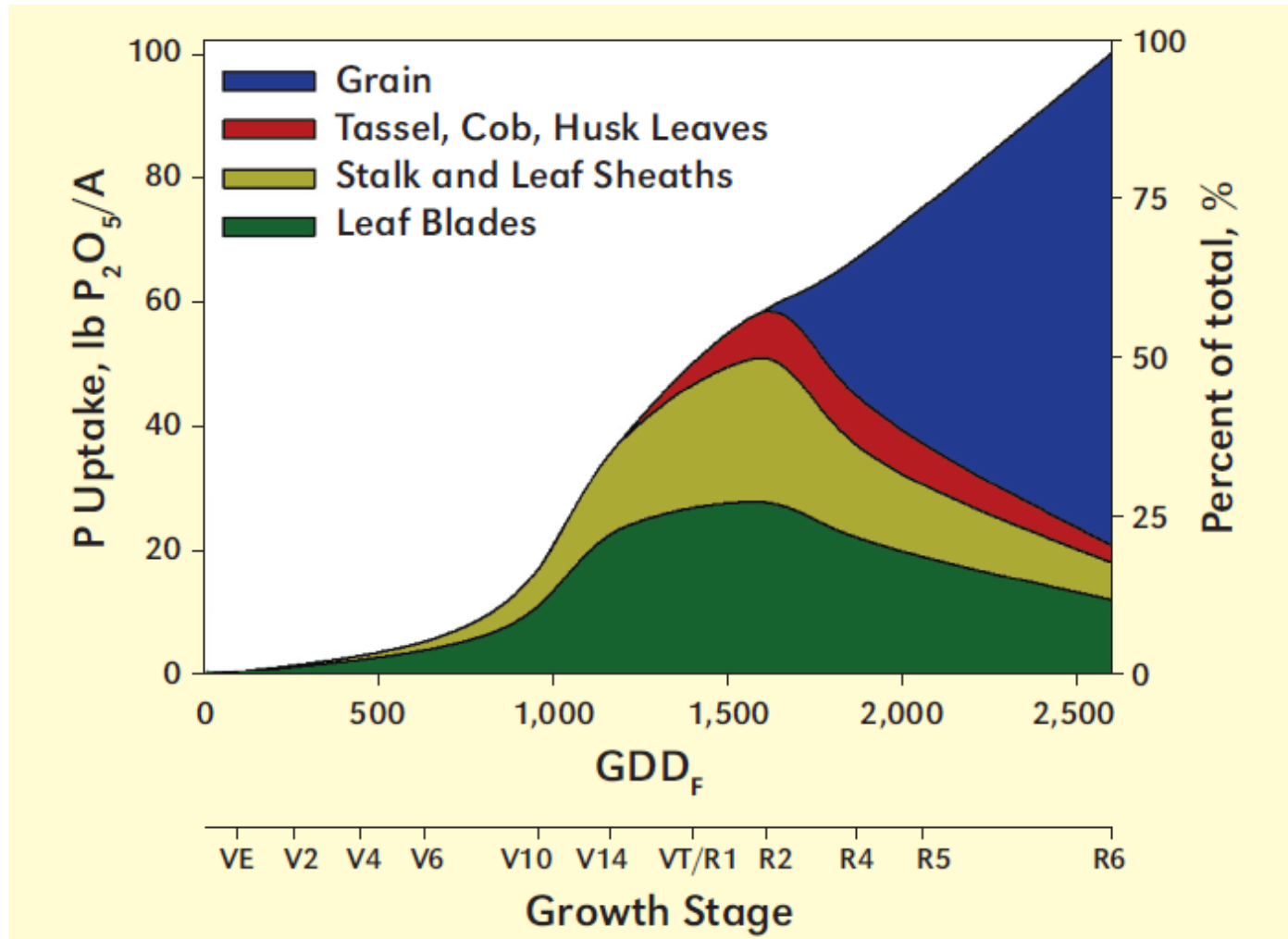


Least significant difference  
(LSD)<sub>05</sub> = 0.2 (2019)  
0.4 (2020)  
0.4 (2021)

Lithuania, 2019–2020



# Changes in phosphorus uptake by maize



Values are averaged across six hybrids and two locations (Illinois, USA)

R.R. Bender *et al.*, 2013



# Application of P fertilisers for maize grown for grain

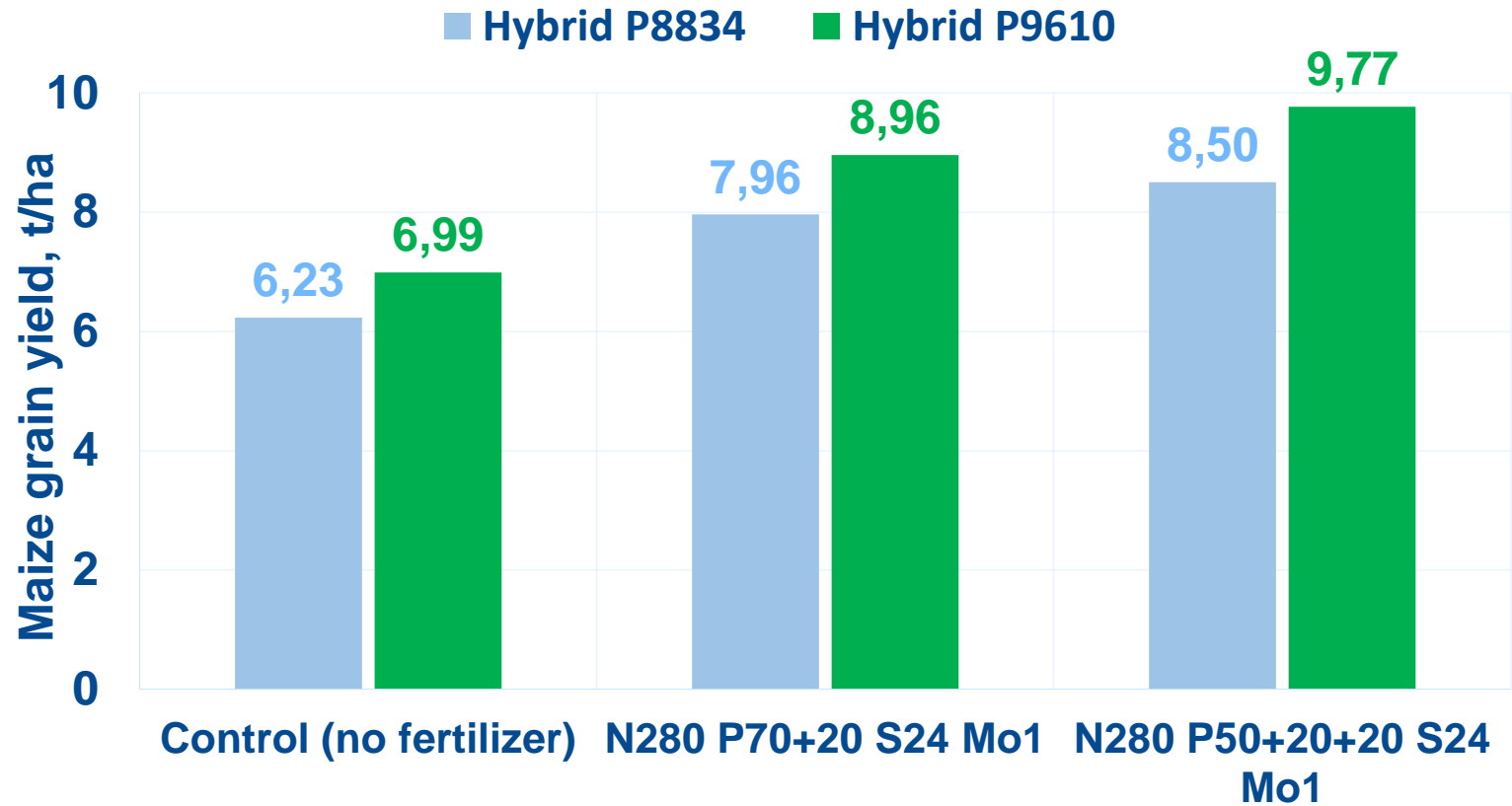
No.	Trial option	Fertilisers	Physical weight, kg/ha	Application method
1	Control	No fertilizers	-	-
2	$N_{280}P_{70+20}S_{24}Mo_1$	<b>Apaliqua® NP 11-37 (APP)</b>	189	Sprayer application for pre-sowing treatment
		Urea	404	Broadcasting for pre-sowing treatment
		Ammonium sulphate	100	
		<b>Apaliqua® NP 11-37 (APP)</b>	54	Banding at seeding
		Urea	100	Root application (5 to 7 leaves)
		Mo micronutrient	-	
3	$N_{280}P_{50+20+20}S_{24}Mo_1$	<b>Apaliqua® NP 11-37 (APP)</b>	135	Sprayer application for pre-sowing treatment
		Urea	404	Broadcasting for pre-sowing treatment
		Ammonium sulphate	100	
		<b>Apaliqua® NP 11-37 (APP)</b>	54	Banding at seeding
		Urea	100	Root application (5 to 7 leaves)
		Mo micronutrient	-	
		<b>Apaliqua® NP 11-37 (APP)</b>	54	

Initial content of labile nutrients in soil:  
P – low, K – very high, S – low.

Bulgaria, 2021



# Maize yield



LSD<sub>05</sub> = 0.42

Bulgaria, 2021





# Application of P fertilisers for winter canola

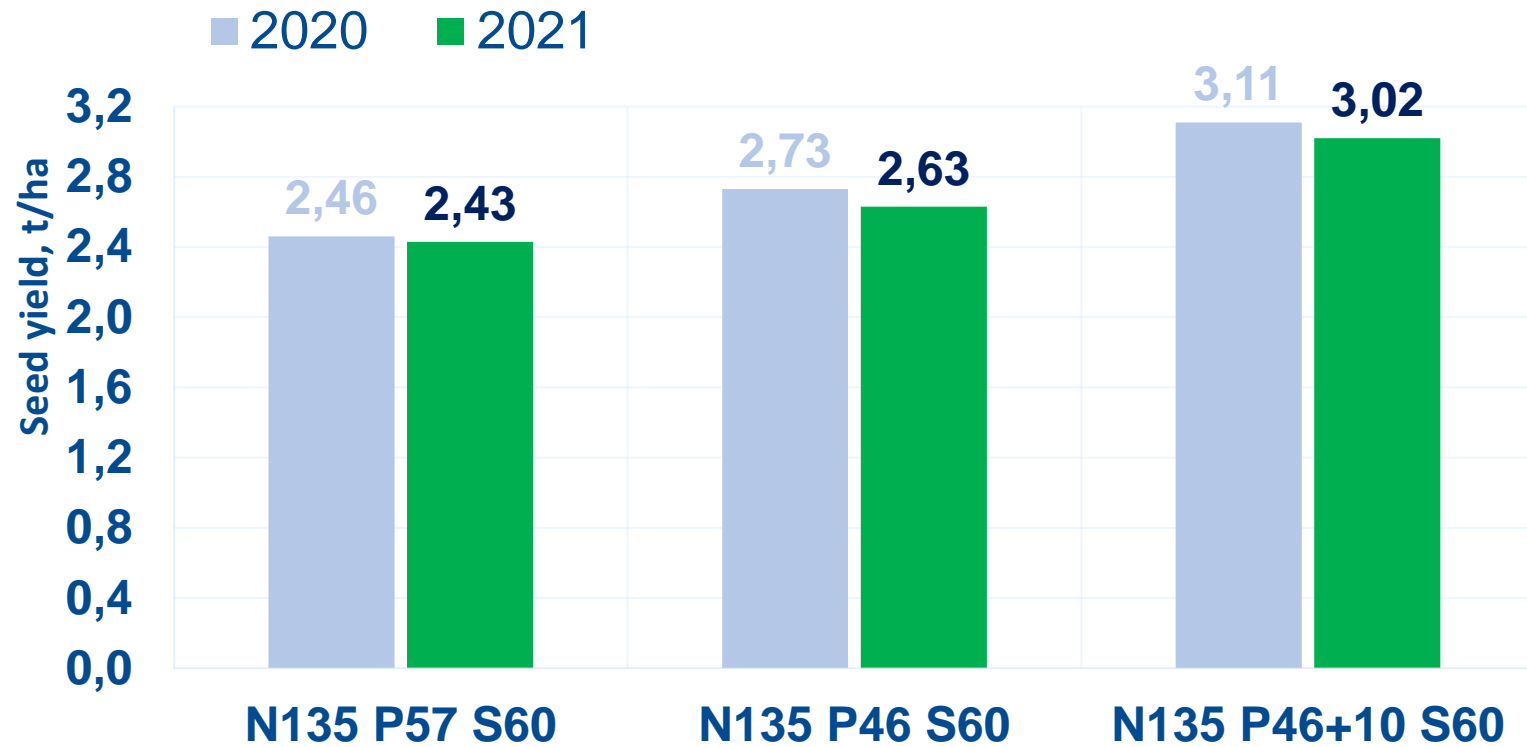
No.	Trial option	Fertilizer	Physical weight, kg/ha	Application method and timing
1	N <sub>135</sub> P <sub>57</sub> S <sub>60</sub>	MAP Apaviva® NP 12-52	110	Broadcasting for pre-sowing treatment
		Ammonium sulphate Nitriva® S	250	Broadcasting (early development of lateral shoots)
		Ammonium nitrate Nitriva® N 34.4	200	
2	N <sub>135</sub> P <sub>46</sub> S <sub>60</sub>	Apaliqua® NP 11-37 (APP)	125	Sprayer application for pre-sowing treatment
		Ammonium sulphate Nitriva® S	250	Broadcasting (early development of lateral shoots)
		Ammonium nitrate Nitriva® N 34.4	200	
3	N <sub>135</sub> P <sub>46+10</sub> S <sub>60</sub>	Apaliqua® NP 11-37 (APP)	125	Sprayer application for pre-sowing treatment
			28	Foliar application (early development of lateral shoots)
		Ammonium sulphate Nitriva® S	250	Broadcasting (early development of lateral shoots)
		Ammonium nitrate Nitriva® N 34.4	190	

Initial content of labile nutrients in soil:  
P – good, K – high.

Lithuania, 2020–2021



# Winter canola yield

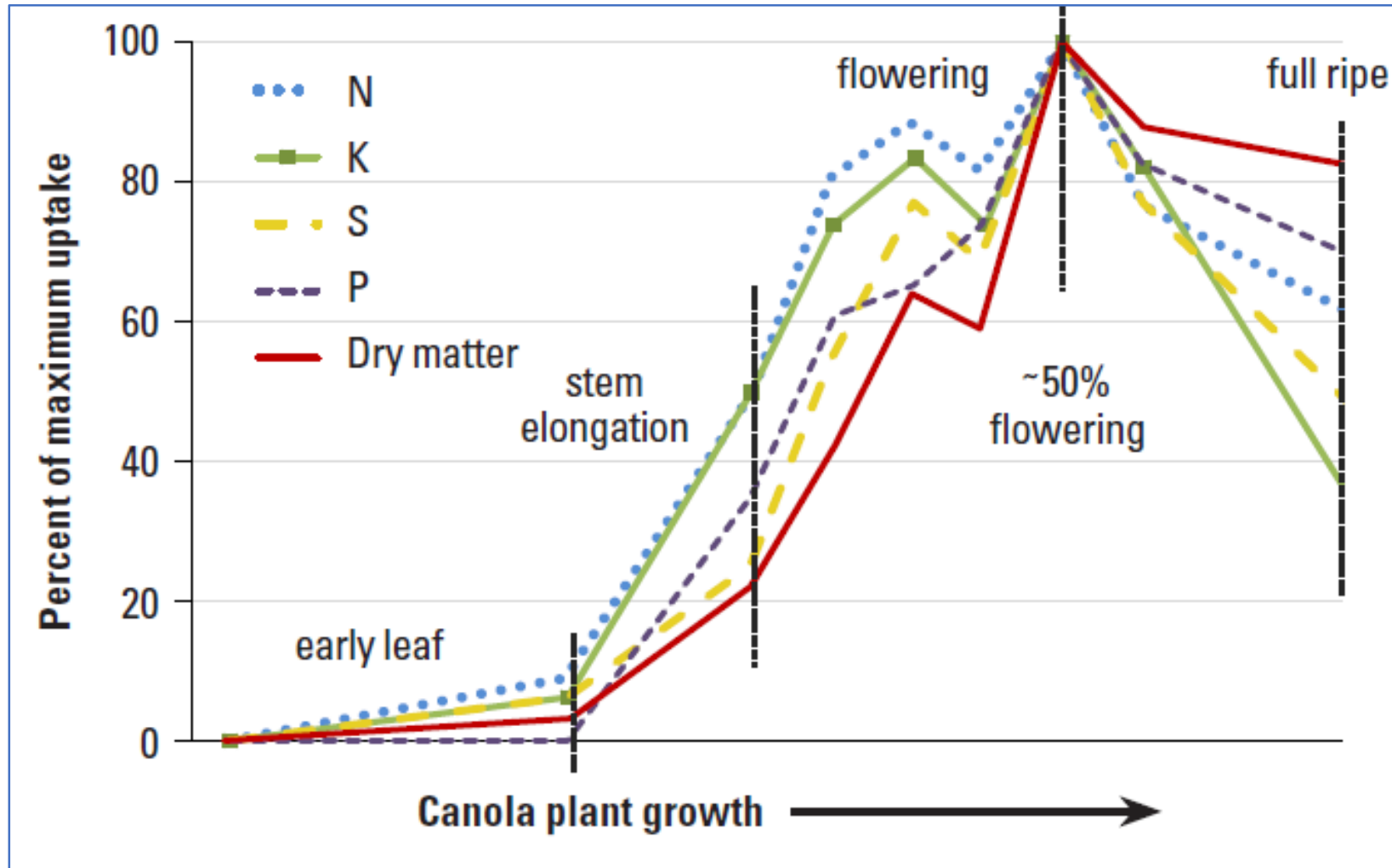


LSD<sub>05</sub> = 0.11

Lithuania, 2020–2021



# Changes in nutrient uptake and dry matter accumulation in canola



C. Jones, K. Olson-Rutz, 2016



# Machinery for subsurface and root application of liquid fertilizers



<https://www.kleverltd.ru>

<https://interagrosnab.ru>



# Fertigation: application of fertilizers through irrigation systems

Fertilizer	Nutrient content, %	Chemical formula	pH (1 g/l, 20°C)
Phosphoric acid	0-52-0	$\text{H}_3\text{PO}_4$	2.6
Monocalcium phosphate (MCP)	0-52-34	$\text{KH}_2\text{PO}_4$	5.5
Monoammonium phosphate (MAP)	12-61-0	$\text{NH}_4\text{H}_2\text{PO}_4$	4.9
Diammonium phosphate (DAP)	21-53-0	$(\text{NH}_4)_2\text{HPO}_4$	8.0



# Nitrogen deficiency symptoms in coconut palm



IPNI Crop Nutrient Deficiency  
Image Collection, 2019



# Range of sufficient macronutrient 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
Potatoes	Middle of the vegetative phase	Petioles of the uppermost fully expanded leaf	2.50–4.00	0.18–0.22	6.00–9.00



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**Thank you!**