

Efficient nitrogen use in selected winter oilseed rape varieties

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Background

Oilseed rape is cultivated in the Czech Republic (CR) on an area 343 thousand ha (year 2024). It accounts for 14% of arable land, making it the second most cultivated crop after winter wheat. Oilseed rape has high nitrogen fertiliser requirements. Farmers normally apply around 180-200 kg N/ha in three doses.

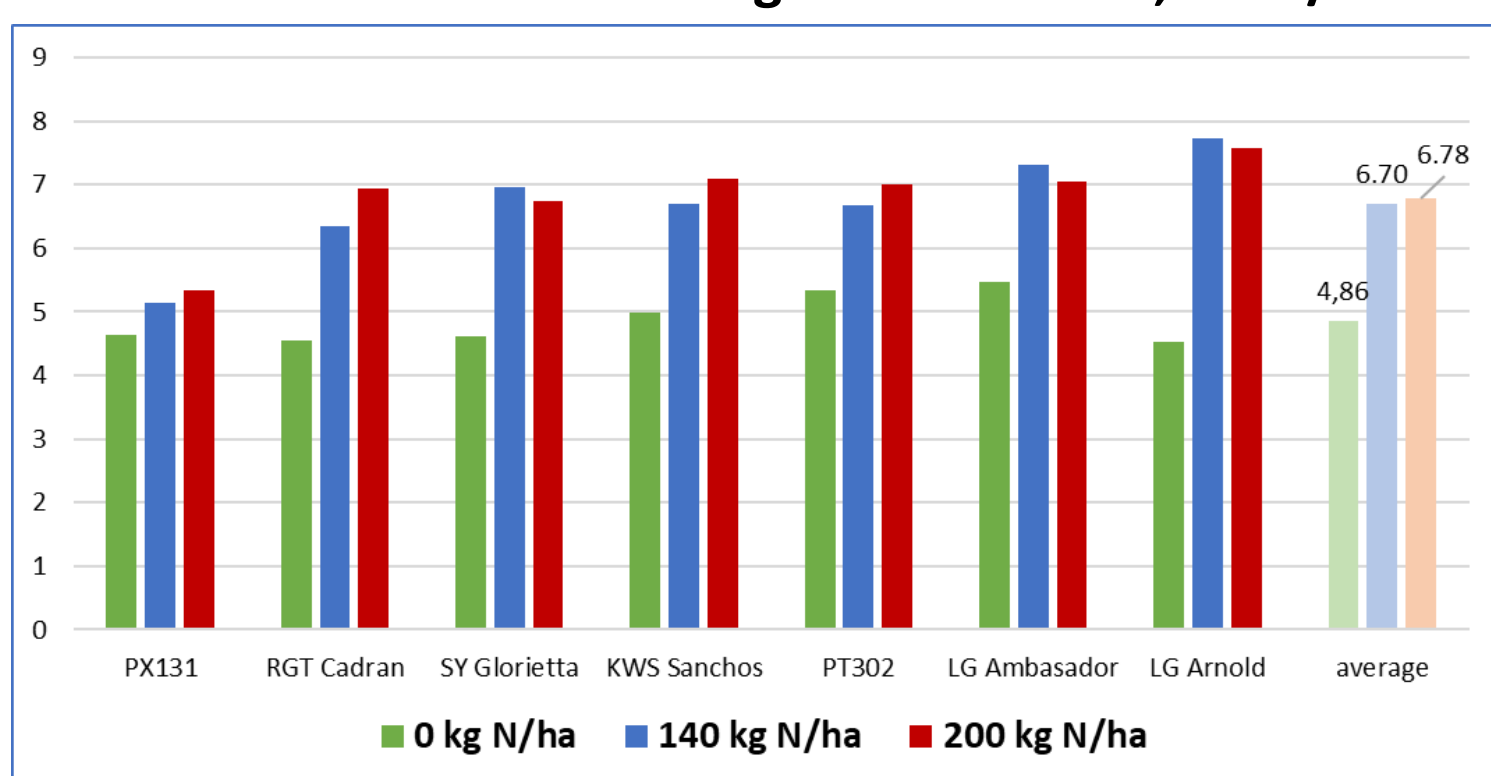
Objective

Oilseed rape is a nitrogen intensive crop. It removes 50-60 kg N/ha per tonne of seed yield. The production of nitrogen fertiliser is very energy intensive and burdens the oilseed rape cultivation by a high carbon footprint. The aim is therefore to breed varieties that will use nitrogen more efficiently and thereby reduce the need for nitrogen fertiliser.

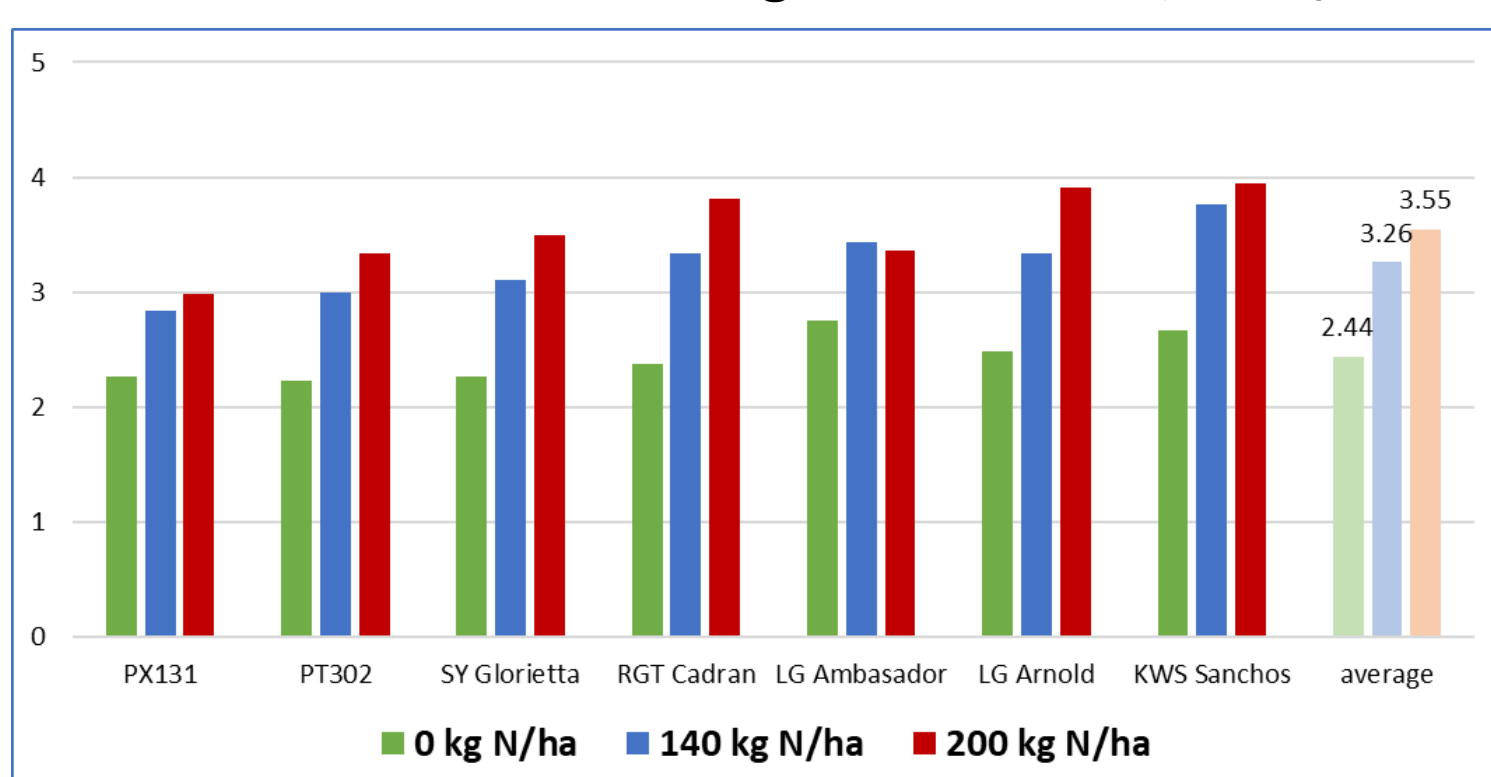
Methods

The small-plot experiments with winter oilseed rape were established in 2022/23 and 2023/24 in the Czech Republic at the Research Station Červený Újezd (GPS 50.0782478N, 14.1726256E). The following treatments were applied: 1) 0 kg N/ha, 2) 140 kg N/ha a 200 kg N/ha. Seven varieties of winter oilseed rape were tested: KWS Sanchos, LG Ambassador, LG Arnold, PT302, PX131 (semi-dwarf), RGT Cadran and SY Glorietta.

Graph 1: Effect of nitrogen rate on seed yield (t/ha) of selected winter oilseed rape varieties at different levels of nitrogen fertilisation, 2022/23.



Graph 2: Effect of nitrogen rate on seed yield (t/ha) of selected winter oilseed rape varieties at different levels of nitrogen fertilisation, 2023/24.



Results

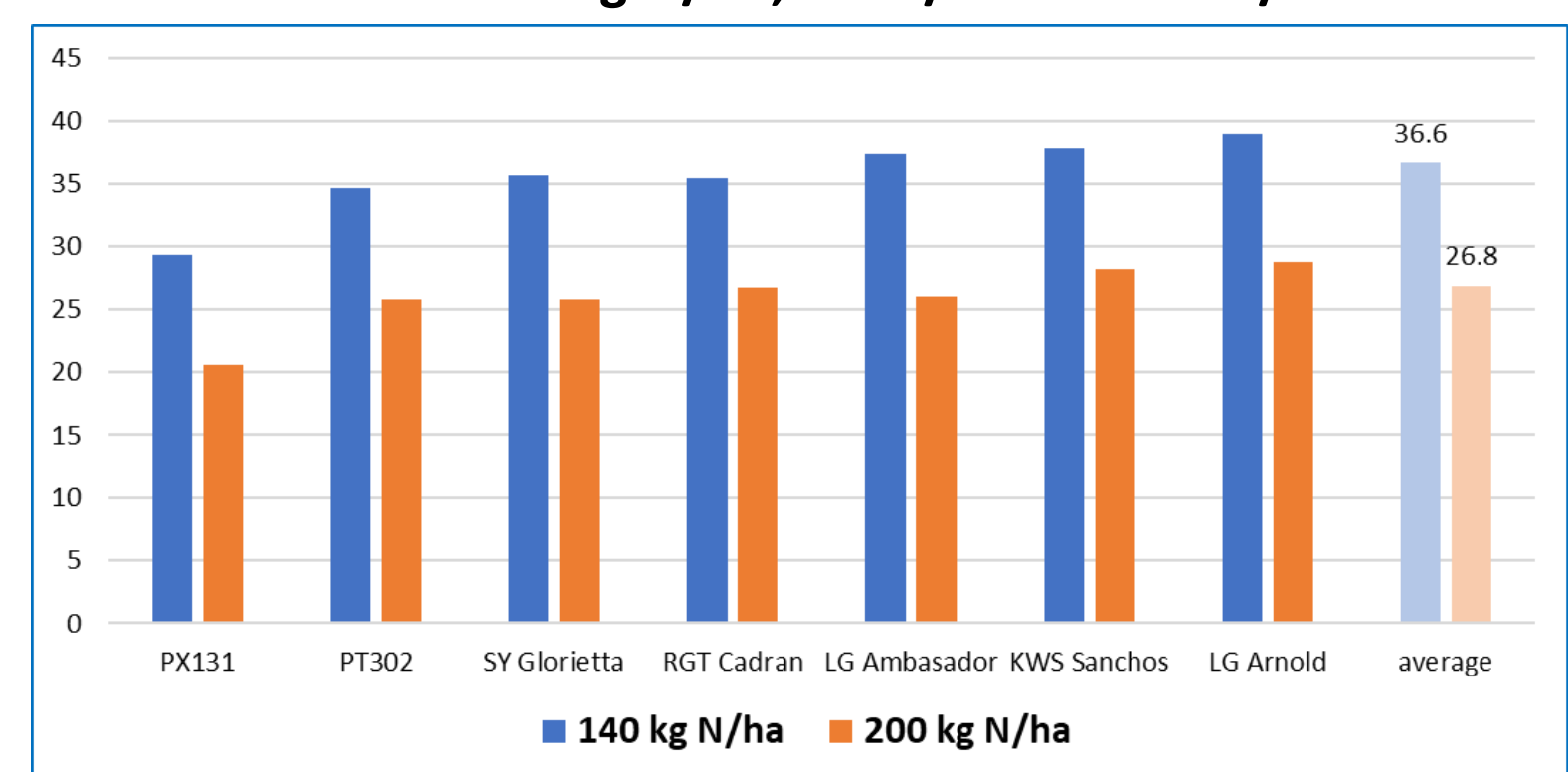
As nitrogen application rate increased, seed and straw yield increased, but oil content and TSW decreased and stem disease infestation increased. The semi-dwarf variety PX131 responded least to increasing nitrogen rates, while the highest yield increase after nitrogen fertilization was observed in the varieties LG Arnold, RGT Cadran and SY Glorietta. The LG Ambassador variety applied with 200 kg N/ha yielded 0.252 t/ha (2022/23) resp. 0.067 t/ha (2023/24) less than when applied with 140 kg N/ha (Graph 1 and 2).

The Partial Factor Productivity (PFP) was lowest in the semi-dwarf variety PX131 (29.3 kg/kg N at 140 kg N/ha and 20.6 kg/kg N at 200 kg N/ha, respectively) On the other hand, higher PFP values were obtained by LG Arnold and KWS Sanchos varieties (Graph 3).

Thus, these varieties demonstrated differences in Nitrogen Use Efficiency (NUE). PX131 and PT302 have the lowest NUE, while LG Arnold and LG Ambassador have the highest (Graph 4).

As the nitrogen rate increases, the nitrogen uptake increases for straw, seed and total harvesting. PX131 and RGT Cadran have the lowest total nitrogen uptake, while LG Arnold and KWS Sanchos have the highest (Table 1).

Graph 3: Partial Factor Productivity (PFP, kg/kg N) of selected winter oilseed rape varieties at 140 and 200 kg N/ha, 2022/23 and 2023/24.



Graph 4: Nitrogen Use Efficiency (NUE) of selected winter oilseed rape varieties at 140 and 200 kg N/ha, 2022/23 and 2023/24.

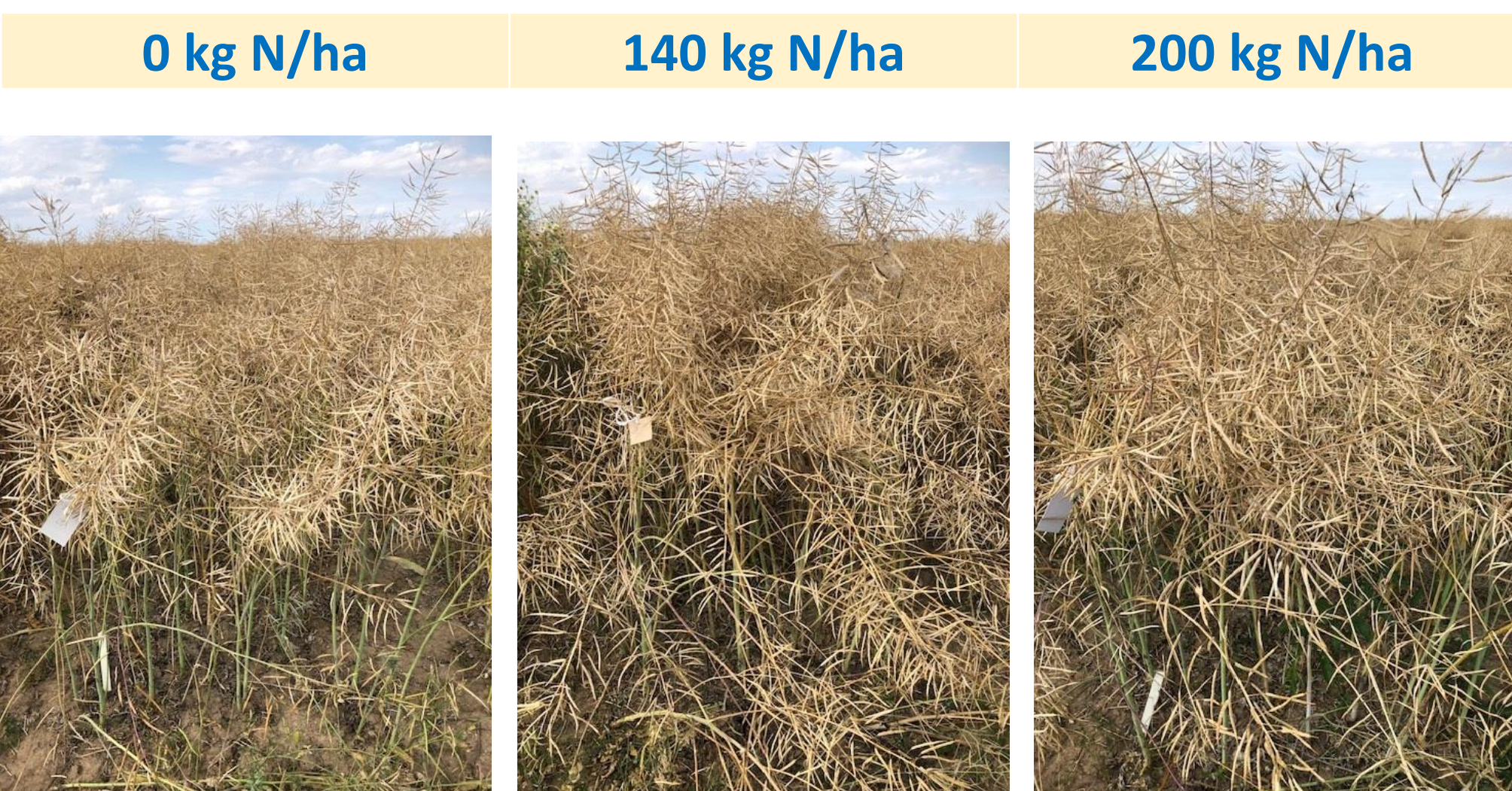
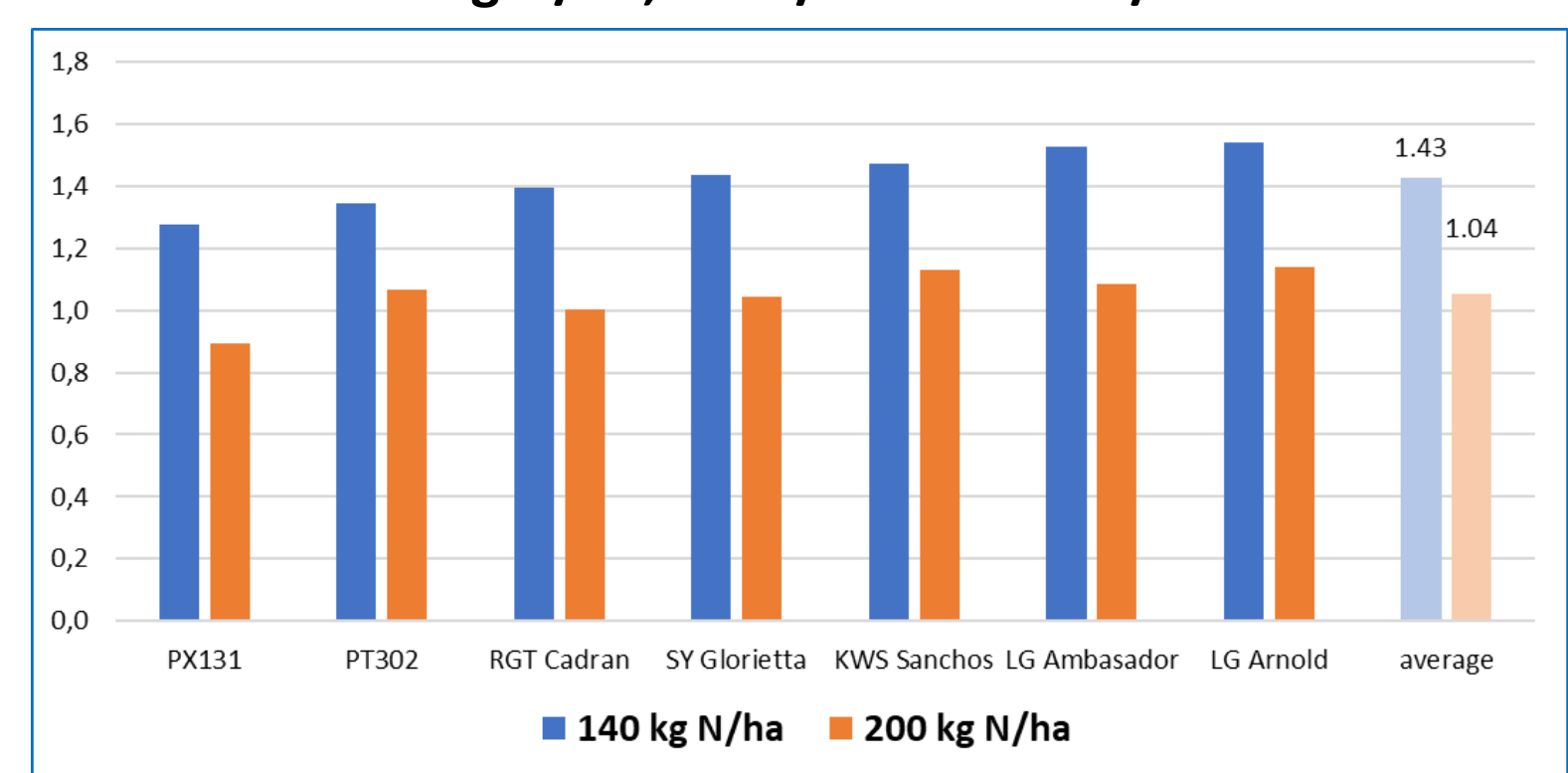


Table 1: Nitrogen uptake by straw, seed and total (kg N/ha) for selected winter oilseed rape varieties at different levels of nitrogen fertilization, 2022/23 and 2023/24.

variety/ nitrogen dose	N uptake by strow (kg N/ha)			N uptake by seeds (kg N/ha)			Total N uptake at harvest (kg N/ha)		
	0 kg N/ha	140 kg N/ha	200 kg N/ha	0 kg N/ha	140 kg N/ha	200 kg N/ha	0 kg N/ha	140 kg N/ha	200 kg N/ha
PX131	41.9	55.0	48.4	88.2	123.8	130.0	130.1	178.7	178.4
RGT Cadran	44.8	54.2	44.2	92.5	141.2	155.9	137.3	195.4	200.1
PT302	41.0	49.8	61.9	94.9	138.7	151.3	136.0	188.5	213.1
SY Glorietta	49.1	54.0	51.0	96.9	146.9	158.1	146.0	200.9	209.0
LG Ambassador	40.5	59.3	55.1	108.7	154.1	161.7	149.2	213.5	216.7
KWS Sanchos	42.6	50.8	48.3	104.9	155.2	178.1	147.4	206.0	226.4
LG Arnold	41.4	53.1	47.0	100.7	162.5	180.9	142.1	215.5	227.8
average	43.0	53.7	50.8	98.1	146.1	159.4	141.2	199.8	210.2

Conclusions

There are differences between varieties in Partial Factor Productivity (PFP), Nitrogen Use Efficiency (NUE) and nitrogen uptake by straw, seed and total at harvest. Varieties also respond differently in yield to increasing nitrogen rates. The semi-dwarf variety PX131 showed the lowest response to increasing nitrogen rates, while the highest yield increase after nitrogen fertilization was observed for the varieties LG Arnold, RGT Cadran and SY Glorietta.