Plasticity of kernel weight in spring rapeseed is highest in a narrow window close to flowering

José Verdejo[1,*], Labra, Marcelo[1,2], Calderini, Daniel[2]

[1] Graduate School, Faculty of Agricultural Science, Universidad Austral de Chile, Campus Isla Teja, Valdivia, Chile
[2] Institute of Plant Production and Protection, Universidad Austral de Chile, Campus Isla Teja, Valdivia, Chile
* E-mail author: jose.verdejo.a@outlook.com, Phone number: +56 9 79141096

Introduction

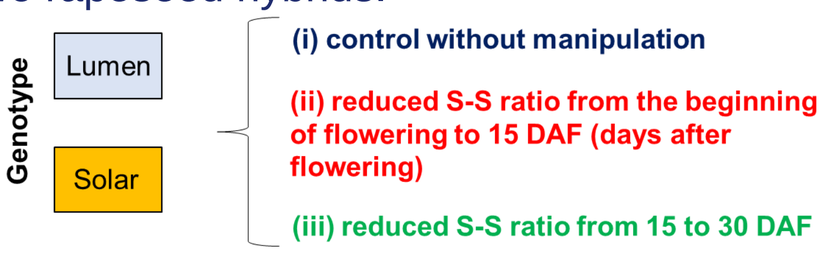
Understanding plasticity of grain yield components to the availability of assimilates and growing conditions is a key to continuing increasing grain yield of rapeseed and to face the challenge of satisfying the food demand in the 21st Century. A previous study (1) showed that thousand kernel weight (TKW) of rapeseed has very high plasticity, even to compensate kernel number (KN) reduction. However, the timing to, and the mechanisms that, maximize the plasticity of TKW are still little understood.

Objectives

- To evaluate the development phase and mechanisms that allow the TKW plasticity
- To study the interaction between TKW and KN and involved mechanisms in rapeseed.

Materials and Methods

Two spring hybrid (NPZ-Lembke, Germany) were evaluated at field conditions in Valdivia, Chile (39°47´S, 73°14´W). The experiment was sown on September 3 (2018) in a Duric Hapludand soil. The effect of three source-sink ratios (S-S) treatments on the response of GY, KN and TKW crop were assessed in two rapeseed hybrids.



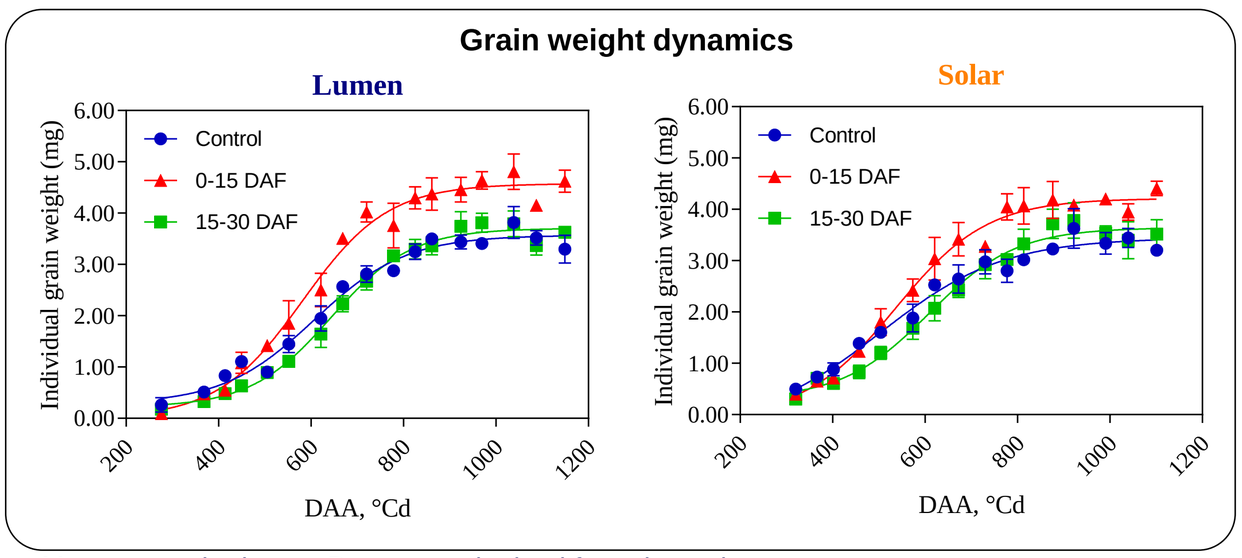
The S-S ratio was decreased by shading the crop with black nets intercepting 75% of solar radiation assuring air circulation and pollinators access. The experiment was conducted under optimum management.

Results

A significant reduction of KN was found under both treatments decreasing the S-S ratio, while increases of TKW were only found in the 0-15 DAF treatment. KN reduction ranged between 37 and 44% in the 0-15 DAF treatment and from 25 to 46% in the 15-30 DAF treatment. On the other hand, TKW improved by 15-39% in the 0-15 DAF treatment and from 0 to 5% in the 15-30 DAF treatment. Higher TKW was achieved by the increase of kernel filling rate. Grain yield was affected under shading by 23-27% because the gain in TKW partially compensated KN decrease.

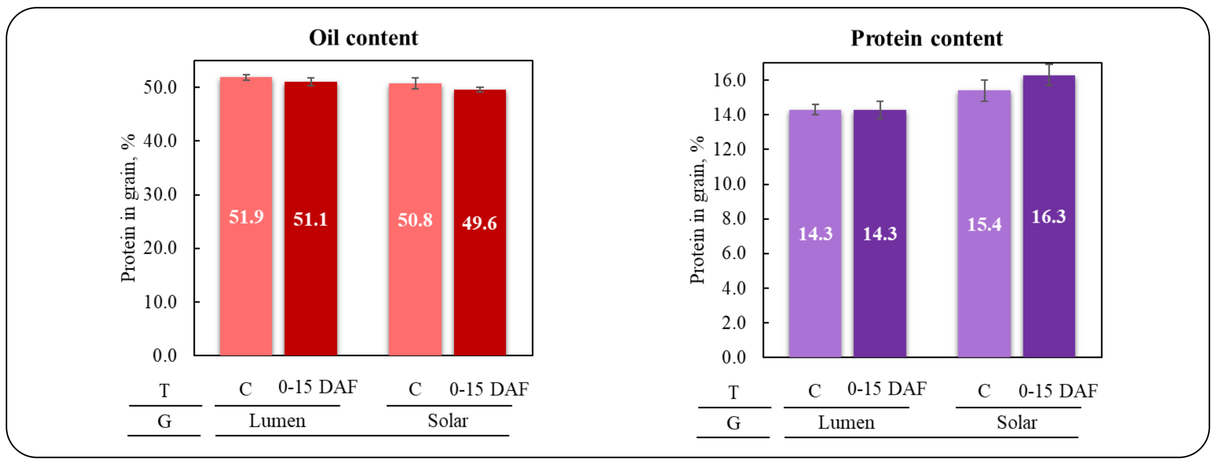
		Grain yield (Mg ha^{-1})	KN (10^3 m^{-2})	TKW (g)
Genotype	Shading			
Lumen	Control	7.0 ± 0.3 a	214 ± 6 a	3.3 ± 0.2 b
	0-15 DAF	5.1 ± 0.8 b ↓ -27%	134 ± 17 b ↓ -37%	3.8 ± 0.2 a ↑ 15%
	15-30 DAF	3.9 ± 0.4 c ↓ -44%	115 ± 18 b ↓ -46%	3.4 ± 0.2 ab ↑ 3%
Solar	Control	6.5 ± 1.8 a	208 ± 50 a	3.1 ± 0.1 b
	0-15 DAF	5.0 ± 0.7 a ↓ -23%	117 ± 18 b ↓ -44%	4.3 ± 0.0 a ↑ 39%
	15-30 DAF	4.8 ± 0.7 a ↓ -27%	156 ± 32 ab ↓ -25%	3.1 ± 0.5 b ↑ 0%
	G	NS	NS	NS
	S	**	***	***
	G x S	NS	NS	NS

Mean ± standard deviation. Data were evaluated by ANOVA. LSD test was used between shading treatments. Asterisks indicate significant differences between treatments at **P < 0.01 and ***P < 0.001, while NS = not significant (P > 0.05),



Mean ± standard error. Data were obtained from the main raceme

Grain oil and protein content were not affected (P>0.05) between the 0-15 DAF and control treatments.



Mean ± standard deviation

Conclusions

TKW showed high plasticity during a narrow window (0-15 DAF), which offers an opportunity to improve grain yield in rapeseed

References:

(1) Labra, M.H., Struik, P.C., Evers, J.B., Calderini, D.F., 2017. Plasticity of seed weight compensates reductions in seed number of oilseed rape in response to shading at flowering. Eur J Agron 84, 113-124.

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