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We research for quality

RaPEQ: Rapeseed as a domestic protein source
of excellent quality for human consumption

Frank-Peter Wolter, Bernd Weisshaar, Benjamin Wittkop, Christian Möllers,
Corinna Dawid, Sarah Bothe, Katrin Heinzelmann, Christian Schein, Sören
Rossmann, Jakob Ley

Sep 26, 2023, Sydney, IRC 2023, Products & Quality



Increasing Demand for Plant Protein

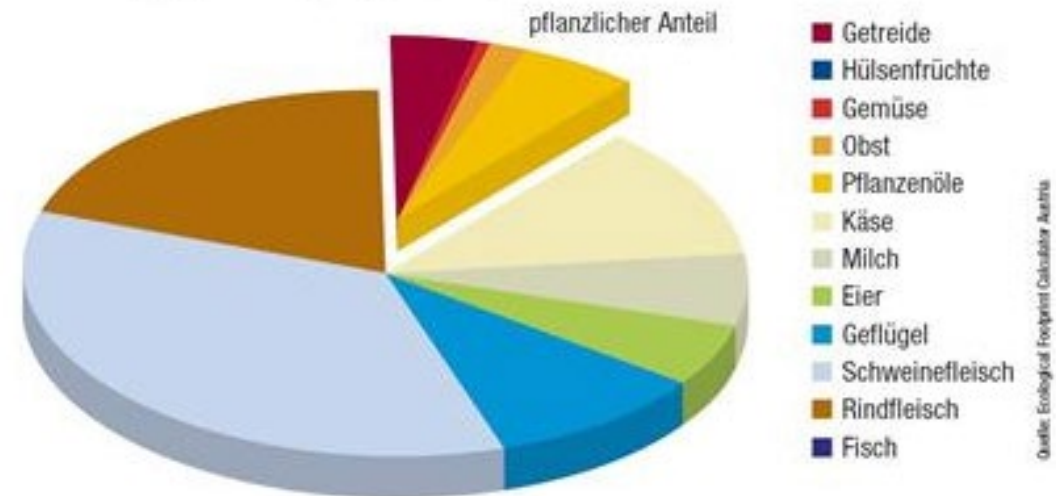
Climate Change: Carbon Footprint

"Around a quarter of the ecological footprint is accounted for by food.

Of this, 80 percent is due to the consumption of animal products (meat, dairy products and eggs)."

Share of food in the nutrition footprint

Ernährung gesamt ca. 1,3 gha (Österreich)

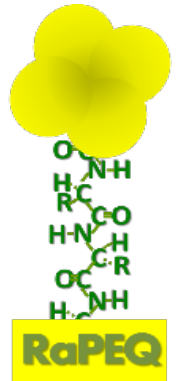
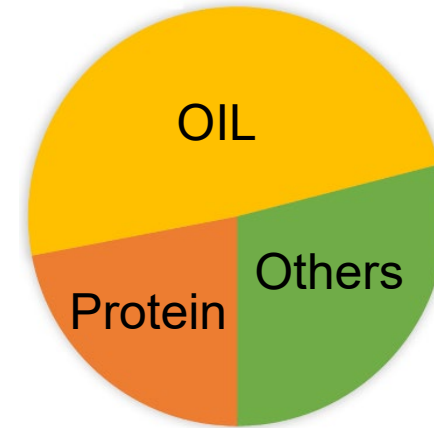


© Quelle: Ecological Footprint Calculator Austria

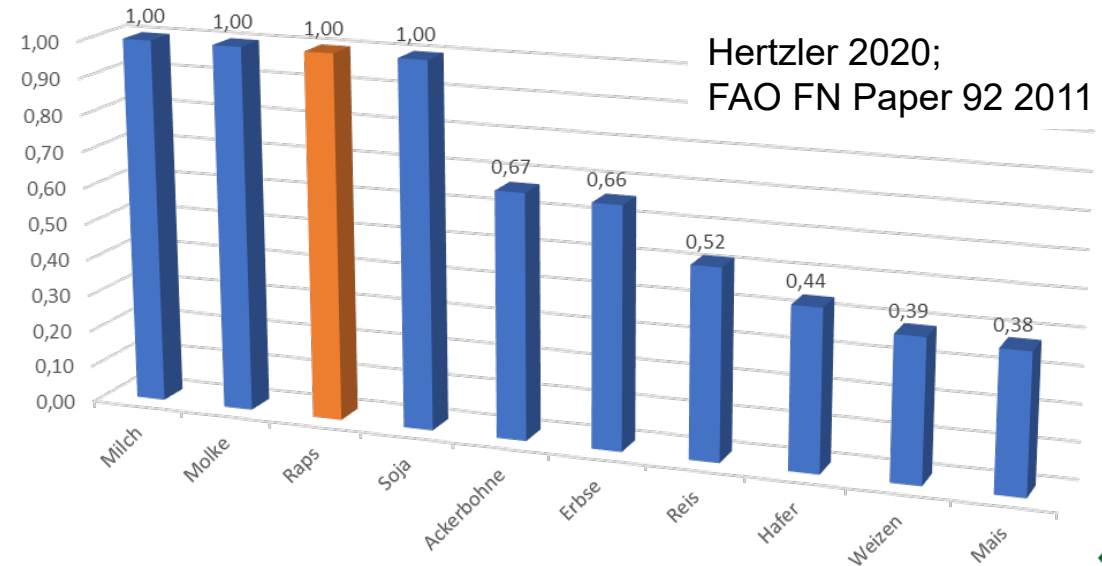
<https://www.salzburg.gv.at/themen/umwelt/nachhaltigkeit/nachhaltigkeit-fussabdruck/tipps-fuer-den-alltag/ernaehrung>

Part of the solution: Rapeseed Protein(RSP)

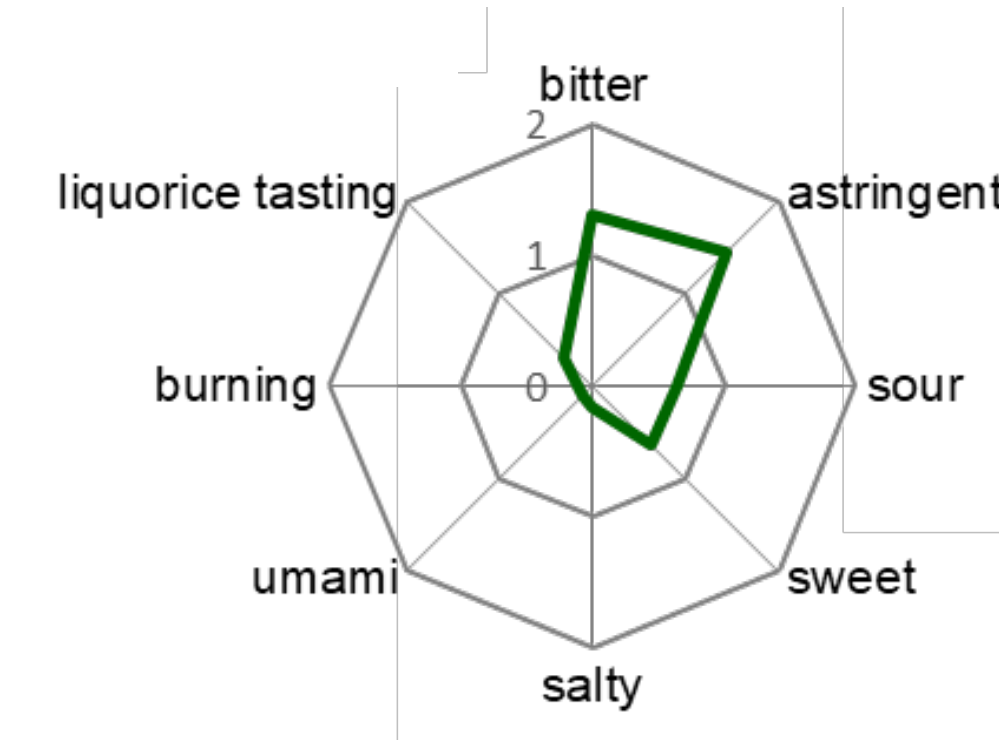
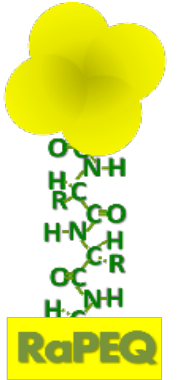
Besides over 40% excellent cooking oil
about **18 % Protein**



**Excellent Nutritional Value
(PDCAAS)**

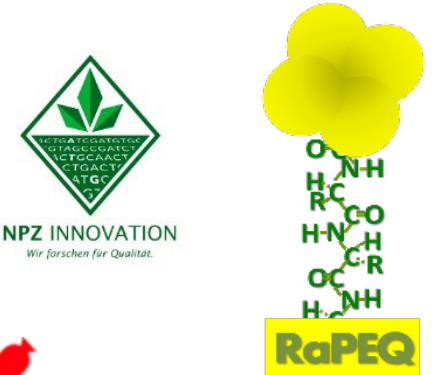


Bitterness of RSP (Rapeseed Protein) / Off taste



RaPEQ Partners

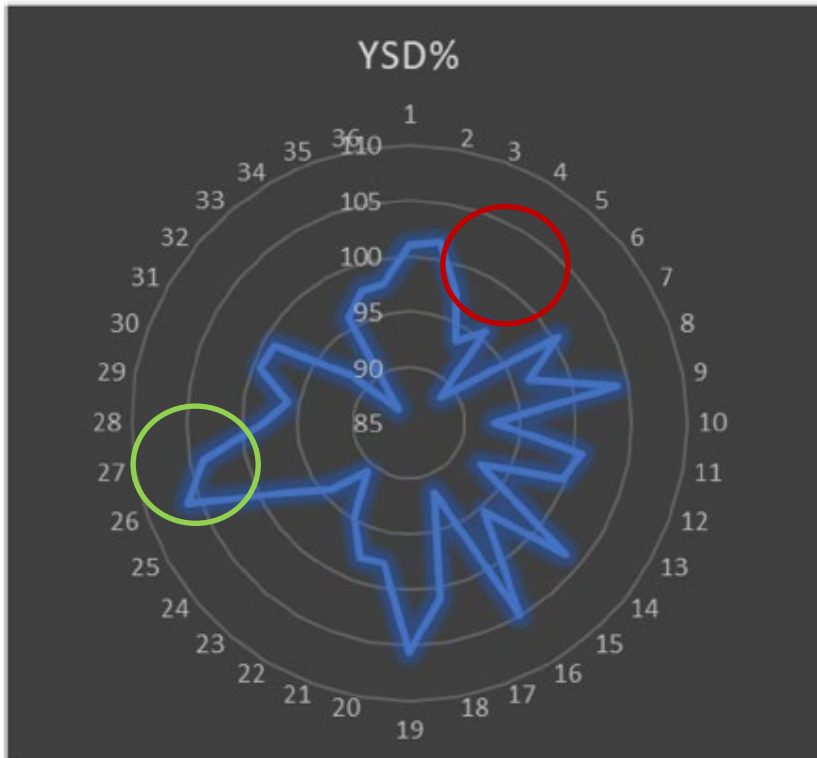
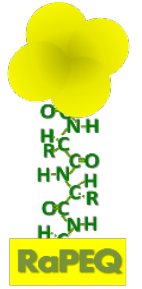
- UBI** - Bielefeld University, Bernd Weisshaar
- JLU** - Justus Liebig University Gießen, Benjamin Wittkop
- GAU** - Georg-August-Universität Göttingen, Christian Möllers
- TUM** - Technische Universität München, Corinna Dawid
- PPM** - Pilot Pflanzenöltechnologie Magdeburg, S. Bothe
- DIL** - Deutsches Institut für Lebensmitteltechnik, K. Heinzelmann
- VTE** - VT-Engineering, Christian Schein
- RÜM** - Rügenwalder Mühle, Sören Rossmann
- SYM** - Symrise AG Holzminden, Jakob Ley
- NPZ** - NPZ Innovation, Frank P. Wolter (coordination)



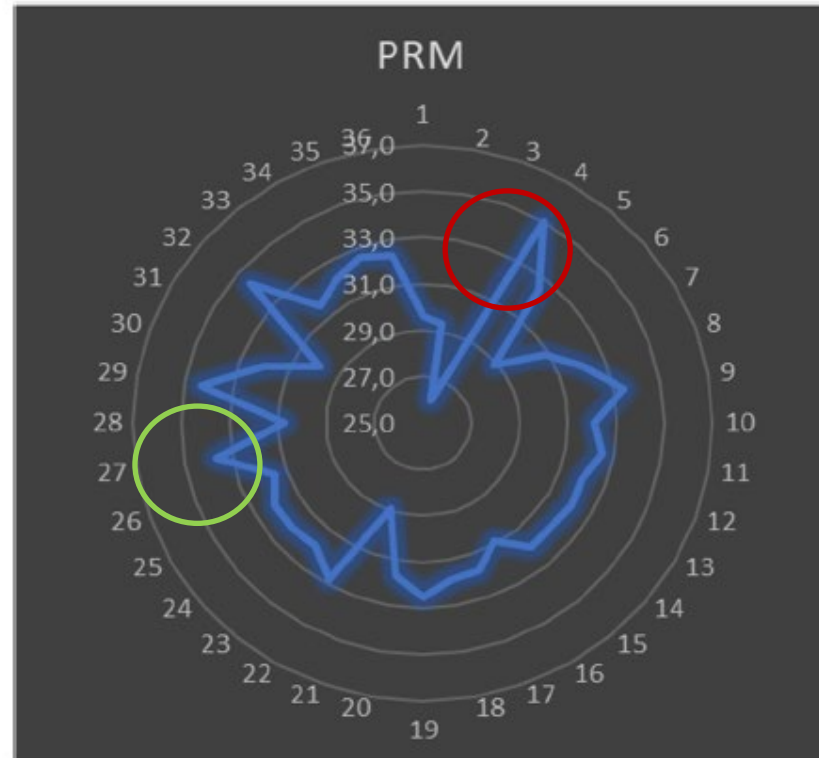
02.10.2023

Protein Yield: Reciprocal recurrent selection for protein in hybrids

36 experimental hybrids tested at 5 locations in 2021/2022



Yield relative to standard varieties

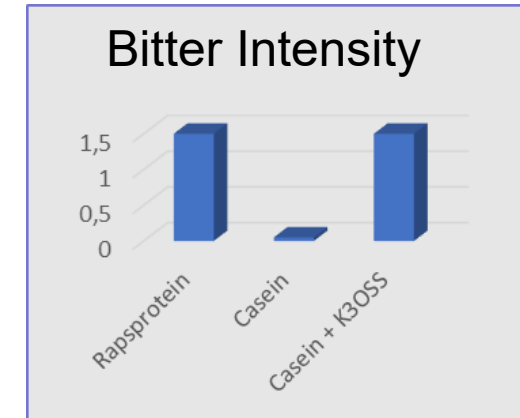
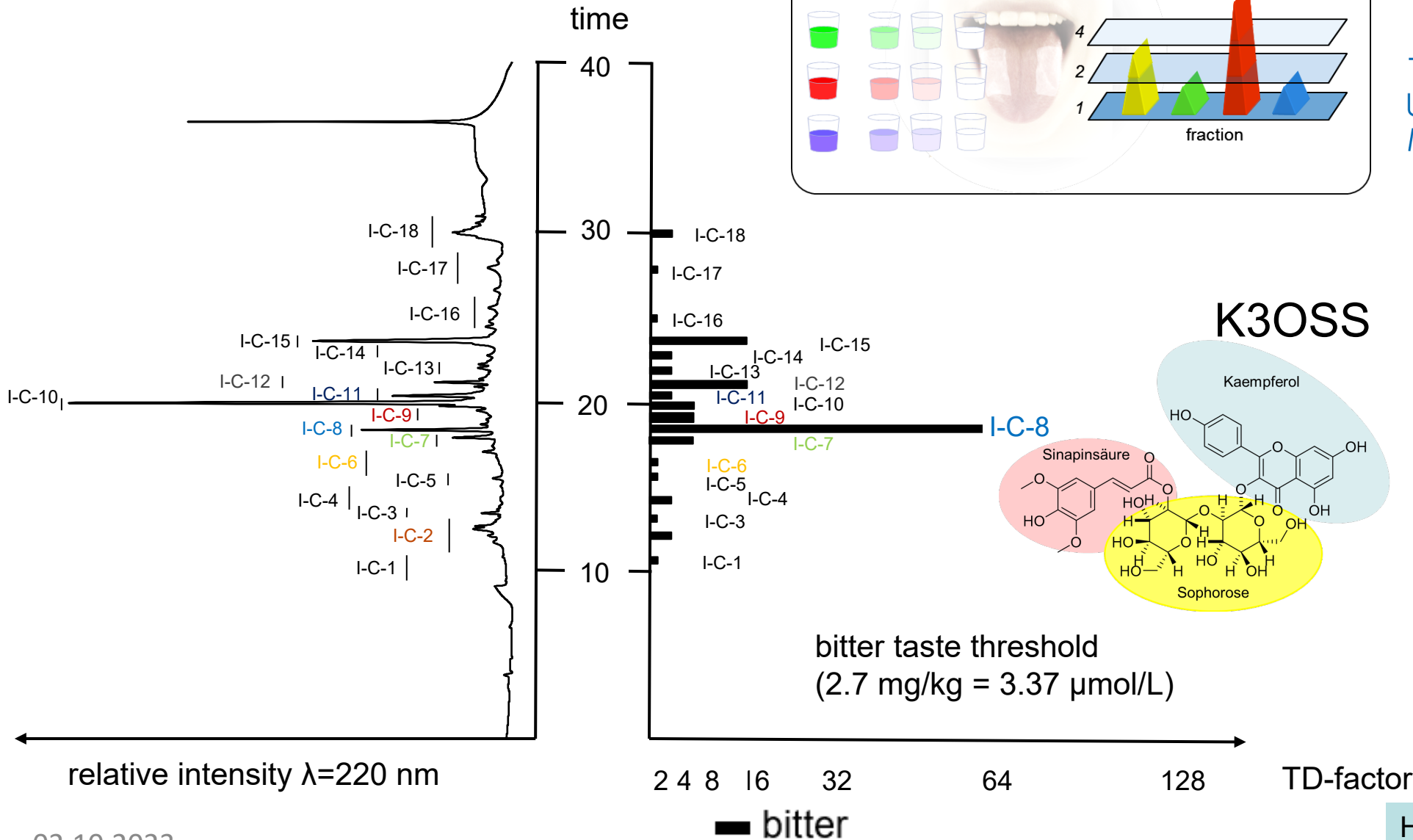
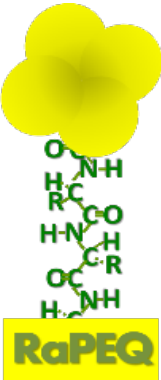
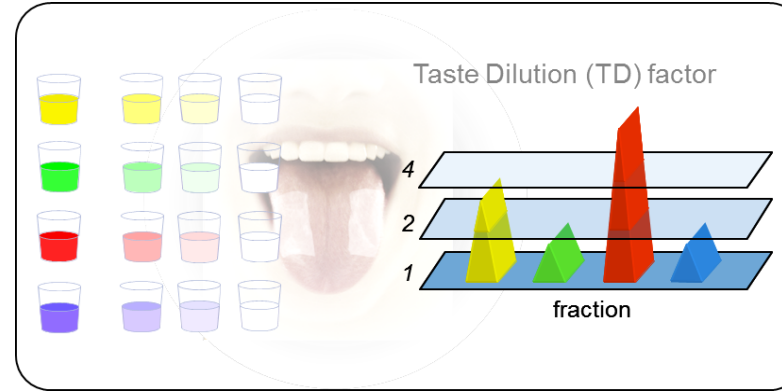


Percent Protein in Meal

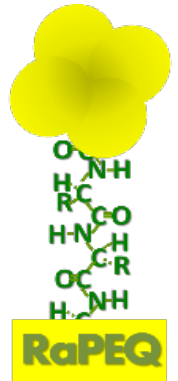


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Molecular Sensomics



Masking



Name	Dose	Base	Panel (n)	Bittermasking in %	t-test
Homoeriodictyol, sodium salt	100 ppm	20ppm K3OSS	20	-15.3	0.2030
Eriodictyol	100 ppm	20ppm K3OSS	20	-43.1	0.0017
Naringenin	50 ppm	20ppm K3OSS	20	-21.5	0.1460
Phloretin	50 ppm	20ppm K3OSS	20	-25.8	0.0920
Matairesinol	50 ppm	20ppm K3OSS	19	-16.7	0.2774

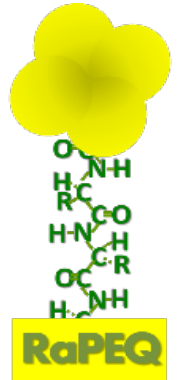


Chicken style vegan “meat” strips (veganes “Geschnetzeltes “)

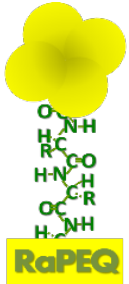
Final Meeting RaPEQ 2 ,
Jan 24th, 2023 Hamburg

Vegan sliced “meat”
strips based on
rapeseed and soy

Good texture, spicy taste.
Harmonizes very well with
chicken aroma.



Biol. Approach: tackle kaempferol biosynthesis



RaPEQ



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FLS Flavonol Synthase

- 13 potential genes in rapeseed genome
- 4 expressed in seeds
- 2 approved FLS activity
- 2 candidate genes
- TILLING lines (*in silico* TILLING)
- potential K.O. mutants for both genes
- validation of mutated lines

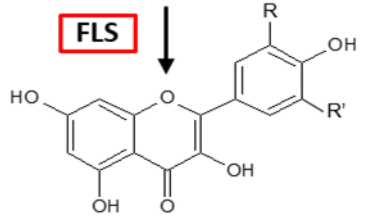
Gene name	Chr.	Exons	AA length	
BnaFLS1.1	C09	3	336	Gln71STOP
BnaFLS1.2	A10	3	336	Trp148STOP

3 x malonyl CoA + 4-coumaroyl CoA

CHS
↓
naringenin chalcone

CHI
↓
naringenin

F3H
↓
dihydroflavonols

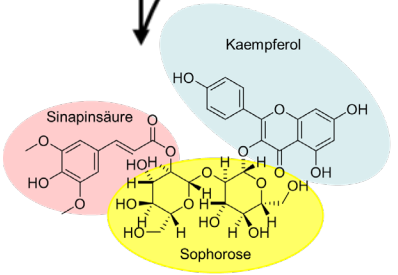


flavonols

R=H, R'=H: kaempferol; R=H, R'=OH: quercetin;

UGTs
↓
glycosylated flavonols

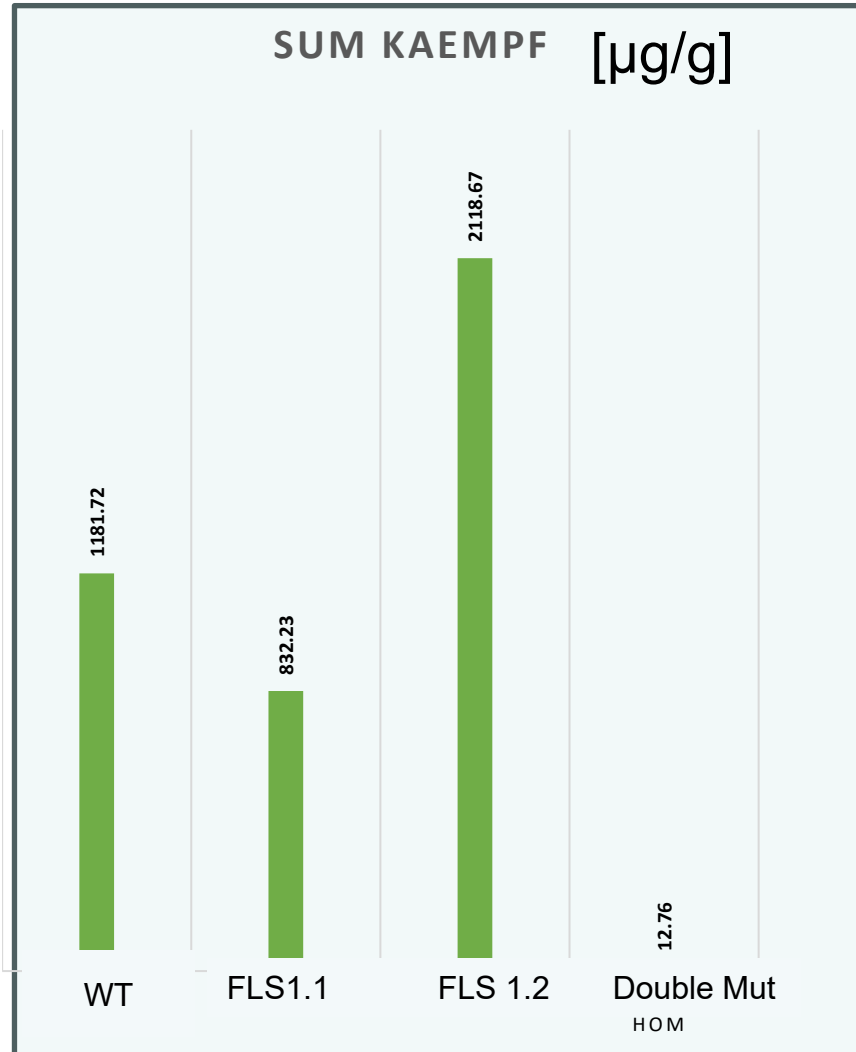
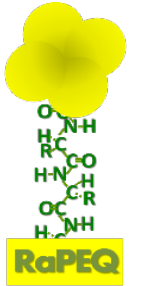
sinapate pathway



K3OSS

= K3OSS

FLS Mutants: Kaempferol reduction in seeds



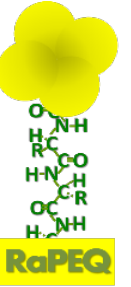
	SUM	K3OSS	No	Percent	Reduc.
WT	1181,72	6,33	17	100,00	0,00
FLS1.1mut	832,23	3,27	92	70,43	29,57
FLS1.2mut	2118,67	24,07	36	179,29	-79,29
Double Mutant	12,76	0	31	1,08	98,92

FLS1.1: Reduction 30%
 FLS1.2: Increase um 80%
 Double Mut. Reduction 99%

=> Presentation #156



Summary & Outlook



Rapeseed Protein

- high quality
- high availability
- limiting factor for use in human nutrition: off-taste

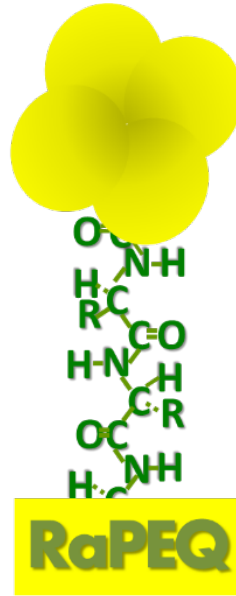
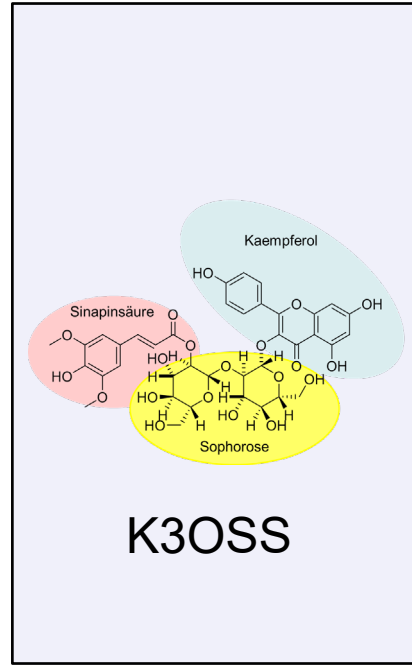
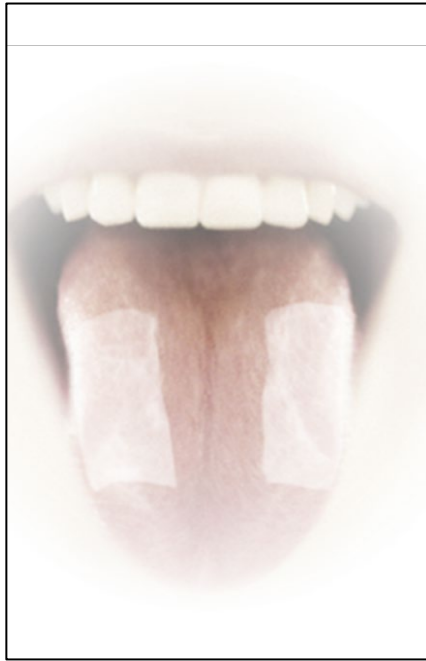
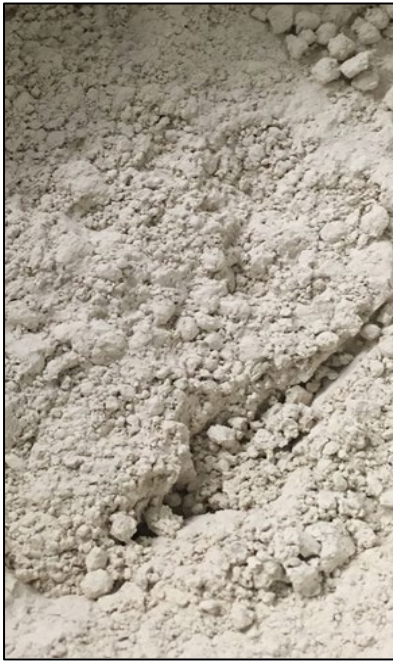
The RaPEQ project contributes technological solutions:

=> direct use of press cake from hulled seeds & off-taste masking

as well as biological solutions:

=> reduction of kaempferol biosynthesis in the seed.





Thanks

To all RaPEQ partners for constructive and trustful cooperation
To the BMBF (German Research Ministry) funding
To you for your attention



Federal Ministry
of Education
and Research



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