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# Significant reductions in oil quality and lipid content of oilseed rape (*Brassica napus* L.) under climate change

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**Abstract**

Despite of the potential importance to food and bioenergy purposes, effects from climate change on plant oil quality have hardly been characterized.

On a global basis *Brassica napus* L., rapeseed or oilseed rape, is the second largest source of vegetable oil after soybean and the predominant oil crop in Europe. We found significant changes in oil quality and quantity of four cultivars of oilseed rape grown in five future climate scenarios with elevated [$CO_2$], [$O_3$], temperature and combinations hereof (~RCP8.5,(1)). Populations of the cultivars were grown under ambient and climate change conditions in a climate-phytotron. The treatments were ambient (360 ppm $CO_2$, 19/12 ˚C (day/night), 20/20 ppb $O_3$ (day/night)), all factors elevated (650 ppm $CO_2$, 24/17 ˚C , 60/20 ppb $O_3$), as well as two- and single-factor treatments with the elevated factors.

The overall trend was that oil content and quality were significantly reduced, except in the scenario with elevated [$CO_2$] alone. Of the six analyzed fatty acids five - oleic acid (C18:1), linoleic acid (C18:2), linolenic acid (C18:3, omega-3), palmitic (C16:0), eicosenoic acid (C20:1) - showed reductions, the only exception being stearic acid, C18:0. For example we found that in the two-factor treatment, where elevated [$CO_2$] and temperature were combined, the essential fatty acid omega-3, C18:3, decreased by 45% and oil content declined 10%.

Total losses in fatty acid and oil yields would be even larger, when also considering reported reductions in seed biomass in the future scenarios (2,3): We estimate that when [$CO_2$] and temperature are elevated simultaneously, the oil yield per hectare will drop 58% and the production of omega-3 (C18:3) will be reduced by 77%/hectare. Also the proportion between saturated and unsaturated fatty acids was changed for the worse. Facing this outlook, breeding for climate tolerant cultivars seems essential for oil yield and quality.


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