Variability of rapeseed oil quality among locations and years

Prediction of oil composition in a climate change context

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Oilseed rape production in Switzerland, mainly used for edible oil, is divided between conventional and HOLL (High Oleic Low Linolenic) varieties. The first ones, rich in omega-3 fatty acids (alpha-linolenic acid, ALA), are appreciated for their health value but must be used without heating. The HOLL ones, with a reduced polyunsaturated fatty acid content, have been specially bred for frying oil production. For both kind of varieties, conventional and HOLL, quality (i.e. fatty acid profile) is very important : ALA content must be high in conventional varieties in order to represent a good source of omega-3, and as low as possible in HOLL ones to have a good stability at high temperature.

Several studies led to a better understanding of rapeseed oil composition variability, and pointed the importance of temperature during seed filling. Combining the relationship between ALA content and minimum temperature during a period determined from the onset of flowering (Baux et al., 2008), and the prediction of flowering date according to Habekotté (1997), it was possible to build a simple linear model to predict ALA content knowing the kind of variety (conventional or HOLL), sowing date, temperature during the vegetative growth and latitude. The prediction was quite satisfactory for conventional varieties but the accuracy was still very low for HOLL ones. It was assumed that the mutations decreasing desaturation in HOLL varieties also decreased their temperature sensitivity. Therefore, other variability factors, with minor impact in conventional varieties, could have more importance and should be taken into account to improve the prediction. A better knowledge of variety characteristics would improve the prediction accuracy as well. Nevertheless, this very simple model, with an "average" variety, can already be useful for i) testing the impact of various scenarios on oil composition (e.g. delaying sowing date), ii) comparing various production areas for there "potential fatty acid composition", iii) estimating the influence of climate change on oilseed rape quality.

First results showed that controlling quality through cropping techniques was not efficient (excepted for rotation and tillage, aiming to control volunteers of another kind of variety, mainly conventional among HOLL). Within Switzerland, variability was higher among years than among sites. However, it was still possible to identify locations with potentially higher (or lower) linolenic acid content. Simulations evidenced the progressive diminution of rapeseed oil ALA over years ; this diminution would go on due to the global warming, unless new varieties, less temperature-sensitive, or with higher potential ALA content are bred. HOLL varieties are much less temperature dependant. Oil crushers still expect lower ALA content. Event with optimal weather conditions, the quality objectives cannot be achieved with the varieties currently available. New varieties with lower ALA content are needed to meet the demand.