

## How oilseed rape was made one of the most important oil crops of the world

Rapeseed is today the second or third most important oil crop of the world. In old days rapeseed oil was of minor importance and the oil was mostly used for lamp oil and certain industrial purposes in Western countries. However, on the Indian subcontinent rapeseed oil and similar oils from close relatives have been used for food for centuries.

### Improving the oil quality

Before 1970 rapeseed contained high amounts of erucic acid, around 50 % of total oil. Based on observations in rats, erucic acid was considered harmful to humans. For this reason researchers tried to find exotic sources of rapeseed with another fatty acid composition.

In 1959 Canadian plant breeders discovered a few mutants in the German spring oilseed rape variety LIHO containing low levels of erucic acid. This was a ground-breaking discovery. A program of backcrossing and selections was initiated to transfer the low-erucic trait into agronomical adapted cultivars. This led to the release of the first low-erucic-acid rape (LEAR) cultivar of *B. napus*, ORO, in 1968. Since then this type of oilseed rape rapidly took over the market and the area of cultivation expanded a lot. Already in 1971 LEAR varieties covered 160.000 ha in Canada.

Low erucic acid per definition: Less than 2% of total fatty acid. The oil composition of LEAR varieties is roughly as shown below. Such oil is considered among the most healthy plant oils for humans.

Fatty acids in a Standard 00 rape oil (canola oil), source Wikipedia "Canola".

Compound	Family	% of total
Oleic acid	n-9 ( $\omega$ -9)	61 %
Linoleic acid	n-6 ( $\omega$ -6)	21 %
Alpha-linolenic acid	n-3 ( $\omega$ -3)	11 %
Saturated fatty acids		7 %
Palmitic acid		4 %
Stearic acid		2 %
Trans fat		0.4 %
Erucic acid		< 0.5 %

However, more recently firm evidence has shown that erucic acid is more of a threat to rats than to humans and erucic acid is now considered to be neutral to moderately detrimental. Except for children where EFSA (2016) states that high erucic acid exposure may have adverse effects. Still, the LEAR oil is considerably healthier as compared to the high erucic acid oil.

In Europe where winter oilseed rape (WOSR) is king the conversion to low erucic acid rape (LEAR) took longer time because the basis for LEAR was spring oilseed rape. The University of Göttingen and the breeder Norddeutsche Pflanzenzucht were key players. Based on the LIHO mutants the first LEAR variety LESIRA became listed in Germany in 1973.

## Towards a better protein fraction (meal) in rapeseed

Rapeseed meal (press cake) is the by-product of the extraction of oil from rapeseed. It is protein-rich and widely used to feed all kinds of domestic animals. Old varieties of rapeseed, before ca. 1975, contained high amounts of glucosinolates (GLs), 90 – 150  $\mu\text{moles}$  per g seed. GLs were known to be detrimental in rapeseed meal when fed in high amounts to poultry, pigs and ruminants. Its hydrolyzed products, isothiocyanates and other sulfur-containing compounds, interfere with the uptake of iodine by the thyroid gland and contribute in that way to liver disease, fertility problems and to reduce growth and weight gain in animals.

In 1969 a Polish spring rape variety BRONOWSKI with only 15  $\mu\text{moles}$  aliphatic GLs per g seed was identified by Canadian and German researchers. Canadian plant breeders introduced this trait into low-erucic lines. University of Manitoba developed the first low erucic acid, low glucosinolate variety TOWER in 1974. The term "**double low**" is used to describe varieties with low erucic acid and low glucosinolate levels. The name "**Canola**" was registered as a trademark by the Western Canadian Oilseed Crushers in 1978 for oil made from double low varieties. Already in 1980 approximately 80% of the total Canadian rapeseed acreage consisted of double low cultivars.

Today 9.3 million ha of Canola™ is grown in Canada. This includes oilseed rape (*Brassica napus*) as well as its very close relatives: Spring turnip rape (*Brassica rapa*) and today also brown mustard (*Brassica juncea*).

In Denmark, cultivation of spring oilseed rape (SOSR) took off around 1979 and in 1984 194.000 ha of double low SOSR was grown. From 1990 WOSR took the lead (better yields) and to day SOSR is a minor crop in Denmark like it is in most of Europe where winters are not getting too cold.

In Europe in general, because rapeseed is primarily winter types, the development of double low varieties took longer time as compared to Canadian spring oilseed rape. Researchers at the University of Göttingen contributed a lot to the pre-breeding of double low oilseed rape in Europe. The first double low winter oilseed rape (WOSR) varieties appeared on the market in 1985. On the whole the transition was completed around 1990.

The use of low glucosinolate rapeseed enables the feeding industry to use much more rape meal in animal feed as compared to "old days". Still the glucosinolates set a limit to the use of rape meal in animal feeding. The most GLs sensitive domestic animal, the pig, tolerate 12% inclusion of rapeseed meal in its feed with a max content of GLs appx. 16-18  $\mu\text{moles/g}$  meal on condition that the meal has been heat treated (90<sup>0</sup> C for a short time).

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Today the quality of the oil is very similar for spring and winter oilseed rape. However, the content of glucosinolates in WOSR is a little higher as compared to SOSR. The content of glucosinolates for "double low" varieties in the European Union is now below 18  $\mu\text{moles}$  per g seed (mostly WOSR) whereas in Canada (mostly SOSR) the content is below 12  $\mu\text{moles}$ , regulated by law or subsidies.

(The Canadian test for GLs only includes the aliphatic GLs, this makes Canadian GLs figures slightly lower as compared to European GLs figures where indolic GLs also are included in the authorized GL test).

High erucic acid varieties are grown on some 1000 ha's for industrial purposes. A high level of erucic acid makes the oil useful in the production of plastics, lubricants, lacquers, and detergents.

Also varieties with other fatty acid profiles bred for specific purposes, such as oil for deep-frying, exist on the market.