



*...going one step further*



**T21020**

# Oil-seed Rape (*Brassica napus* ssp. *oleifera*)

English

## General information (figure A)

The rape plant belongs to the family of crucifers (brassicaceae, former scientific name: cruciferae). Crucifers are generally characterised by a fixed number of floral components: four calyces, four petals, two short and four long stamens, and an epigynous ovary. The ovary consists of two carpels that are connected by a membranous septum. Depending on the length/breadth ratio of the ovary, we can differentiate between pods (the length is three times the breadth) and silicula (the length is less than three times the breadth). The general flower diagram of crucifers: +K4 C4 A2+4 G(2). Among others, mustard, all species of cabbage, radish and horseradish, as well as common herbs/weeds like lady's smock (*Cardamine pratensis*), shepherd's purse (*Capsella bursa-pastoris*) and garlic mustard (*Alliaria petiolata*). All crucifers are characterised by a uniform petal structure. The difference is only on account of variable forms of the ovary. The rape plant can, therefore, be taken as a model for the entire family.

- 1 Calyx
- 2 Petal
- 3 Stamen, long
- 4 Stamen, short
- 5 Ovary composed of two fused carpels with membranous septum

## Uses of the rape crop

Oil-seed rape probably originated in the eastern Mediterranean region from a natural hybridisation between cabbage (*B. oleracea*;  $2n = 18$ ; CC) and turnips (*B. rapa*;  $2n = 20$ ; AA). Chromosome number  $2n = 38$ ; genome formula AACC. There is proof that the rape plant has been grown in central Europe since the 14th Century owing to the high oil content of its seeds. In former times, rapeseed oil was considered the poor man's oil, however. Due to its acrid taste, the oil was highly unpopular as a cooking medium. This unpleasant taste is firstly on account of the high content of erucic acid, which can damage cardiac musculature, and secondly due to the bitter glucosinolates (= mustard oil glucosides - particularly allyl mustard oil - contained in rapeseed). Even as animal fodder, the use of the crop was limited on account of these constituents. After intensive research and cultivation, 00 rape was introduced in 1985, which now contained oleic acid instead of unsaturated erucic acid (originally 45-52.5%, only 0.1-1.5% in 00 rape), was easier to digest, and where the glucosinolate content had been reduced considerably (<10% of the original content). In terms of the composition of fatty acids, 00 rape oil has practically the same properties as olive oil. The disadvantage is that due to the reduced quantity of bitter isothiocyanates in 00 rape, ruminants venture to eat the rape which, as it can cause anaemia, can be life-threatening. As in former times, rape is cultivated today mainly to produce industrial products. In the Middle Ages, rapeseed oil was used as fuel for oil lamps. In the course of industrialisation, the oil was used as a lubricant in steam engines and as a basic material in the manufacture of soaps. Industrial rape is the most significant oil seed in Germany today. Rape is often considered a renewable, long-term raw material: a major proportion of cultivated rape is used in the manufacture of rape methyl ester (RME) which is commonly known as bio-diesel. The advantages: reduction of CO<sup>2</sup> in the atmosphere that is effected during the growing phase of the plant. It is also biodegradable and produces less soot than mineral diesel when burned. The „old“ oilseed rape, which is rich in erucic acid, is on the other hand a good and renewable source for C20 and C25 fatty acids which are increasingly on demand in the plastics processing and detergent industries. Hence, cultivation of these species is also on the rise (erucic acid = cis-13-docosenoic acid). Due to its limited frost resistance, winter rape is sown as early as mid-August so that it already reaches the rosette stage in its pre-winter development. The sowing of summer rape takes place in Germany as early as possible (February/March). Harvesting the seeds of both species of rape is done in July/August. The average yield is 30-40 decitons per hectare (1 dt/ha = 100 kg/ha). Apart from Europe and China, North America and India are the most important rape growing regions in the world.

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## Structure of the rape flower (magnified 12-fold) (figure B)

Rape blossoms in Germany in May and June. At the axis of the shoot, numerous, unbranched pedicels arise at different levels. Each pedicel has one flower. The inflorescence is subsequently termed „raceme“. Each flower has four small, erect calyces, yellow-green in colour. Between these calyces, four golden-yellow petals are arranged on an inner flower whorl (= crucifers). The small lower sections of the petals build a duct with the calyx; the wide upper sections, on the other hand, are bent at right angles (= pedicelliform). The six stamens are of different length: there are two short and four long stamens. Each stamen consists of a filament and an anther. The latter consists of two halves which contain the four pollen sacs. The elongated ovary has a button-shaped stigma at its top. The entire floral structure is equipped for cross-pollination by insects, primarily bumblebees or bees. However, even wind pollination and, in the event of unfavourable weather, a considerable amount of self-fertilisation can take place. Thus, rape flowers demonstrate the typical characteristics of insect-pollinated flowers: flattened form of the pedicel, conspicuous colours, scent and large quantities nectar with a high sugar content (30-40%, in some cases even up to 60% sugar). This nectar is secreted from four green nectar glands (nectaries) which are located at the base of the stamens. Typical for crucifers, the rape pollen originates in the two short and four long stamens. Tests showed cross-pollination to achieve the best results: the seeds were 19% heavier than when a plant is self-fertilised with its own pollen.

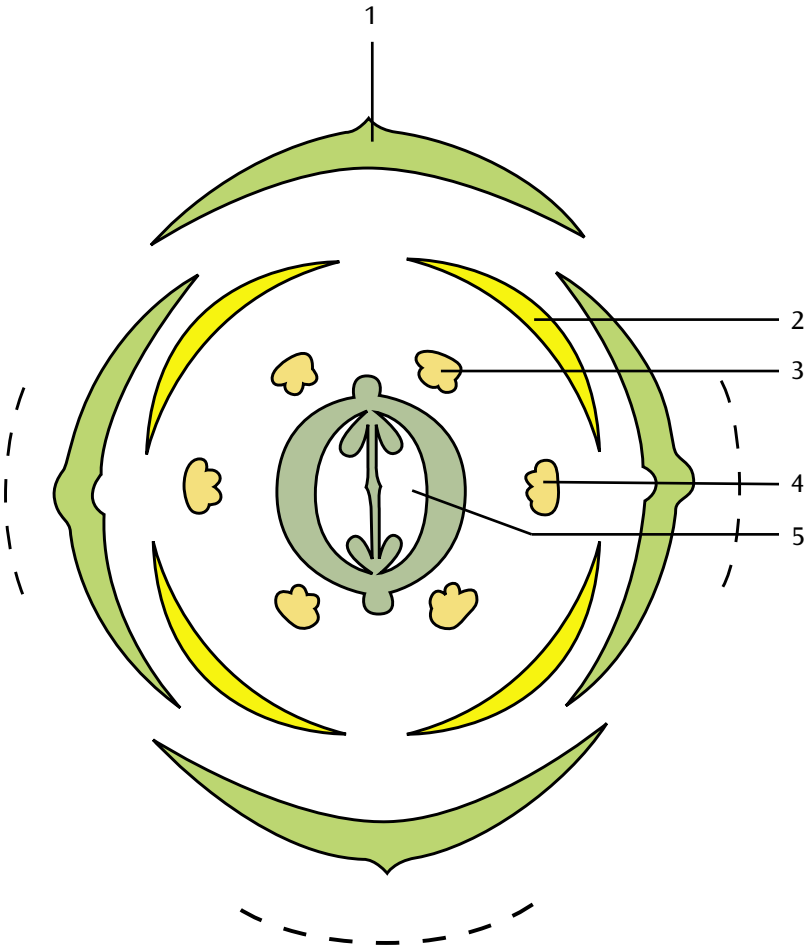
- 6 Petal (sepals)
- 7 Stamen with filament and anther
- 8 Ovary
- 9 Petal
- 10 Nectar gland (nectary)

## Structure of the rape fruit (magnified 3-fold) (figure C)

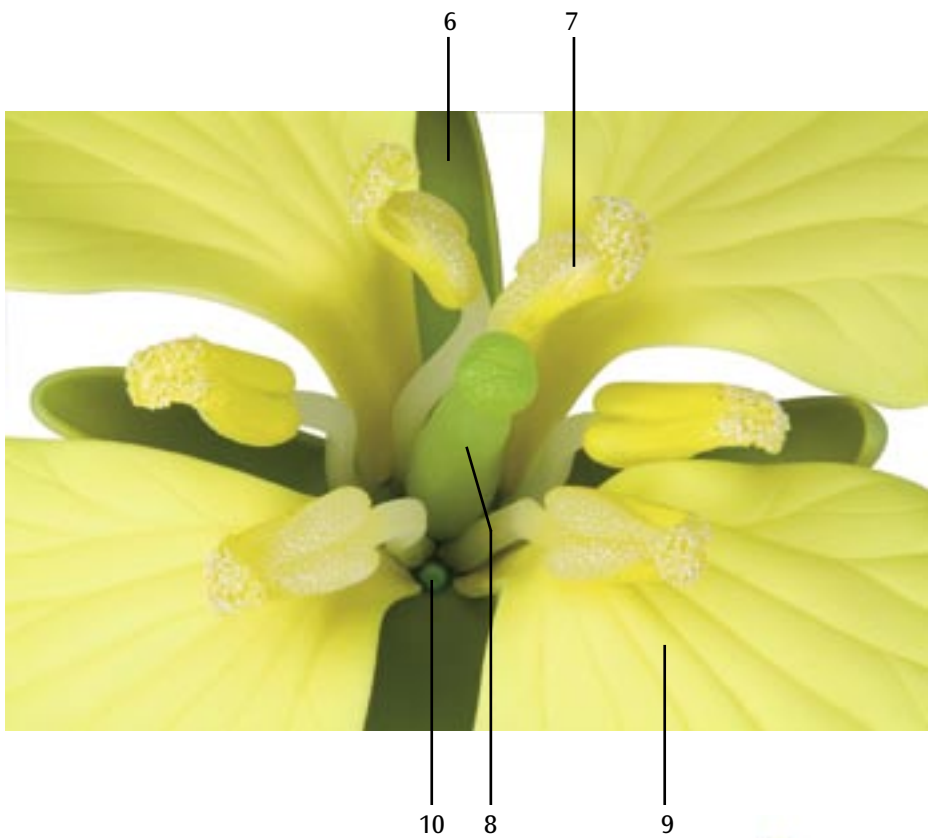
The fruit (as well as the ovary from which it originates) is made up of two carpels, the united peripheries of which each hold a row of seeds and are connected by a membranous septum. Such a fruit is called a pod. In its ripe state, the short-stalked rape pod attains a length of 6-10 cm with a diameter of 3-6 mm and has a thinner tip. Even when the fruit is closed, the seeds can still be anticipated. The polyspermous pod (15-18 spherical seeds) opens when it is ripe. The carpels open out from the bottom like top-hinged flaps so that the membranous septum with the seeds remains still. The seeds are loosely placed on their stalks so that even the lightest wind detaches and disperses them. Harvest of rape thus takes place at a time before the fruits have ripened completely.

Author: Dr. Gerd Vogg, University of Würzburg, Germany

A



**B**



**C**



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