Cultivation

Winter Oilseed Rape

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Oilseed Rape – a long-standing cultivated plant

Rape (*Brassica napus*) is a member of the Cruciferae family. No wild forms are known, but rape probably came into existence as a cross between turnip and cabbage. In Europe the first references to the deliberate use of rape occur in the 14th century. From the late Middle Ages, rapeseed oil was mainly used as a lamp oil.

The rapeseed oil of those days was rather unsuitable for human food because of its high content of erucic acid, but even so it was used as a food oil by the poorer classes.

It was selective breeding which led to its success as an edible oil. Instead of the erucic acid, which is unsuitable for human nutrition, the content of the nutritively valuable C18 fatty acids linoleic and linolenic acids was greatly enhanced. By 1974-76, rape cultivation in Germany had completely switched to these so-called single low (0) varieties. Rape contains an average of over 40% oil, and after oil extraction the remaining rape waste can be used as a valuable protein feed for animals.

A further process of breeding was necessary to make this possible and reduce the content of mustard oils, the so-called glucosinolates, which are harmful for animals. The varieties currently in production are characterised both by lack of erucic acid and by a low content of glucosinolates and are thus known as double low (00) varieties.

Content in original (++) and new (00) rape varieties of fatty acids in rapeseed oil and glucosinolates in waste

Fatty acids (pct. of total)			**Glucosinolates** (µmol/g)		
	++ varieties	00 varieties		++ varieties	00 varieties
Palmitinic acid C16:0	3.8	6.2			
Stearinic acid C18:0	1.1	1.7	Gluconapine	33.3	5.5
Oleic acid C18:1	11.2	59.8	Glucobrassicanapine	8.2	1.0
Linoleic acid C18:2	13.7	19.4	Progoitrine	109.4	8.3
Linolenic acid C18:3	8.1	11.2	Napoleipherine	5.2	0.4
Eicosenic acid C20:1	9.6	0.2			
Erucic acid C20:1	52.3	0.3	Total	156.2	15.3

Source: Prof. Gerhard Röbbelen, Georg August University, Göttingen, revised.

Since then rapeseed oil, with its balanced fatty acid composition and its content of Omega-3 fatty acids has become known as the healthiest of all vegetable oils. Besides its use as an edible oil, in the past few years its use as a sustainable raw material, especially in the form of biodiesel, has developed into a second important field of use.

Growing Technology

Rotation of crops

For crop rotation reasons rape should not cover more than 20-25% of the cultivated area. On the other hand, rape itself is an excellent break crop, especially for winter wheat. As a break crop it leaves an excellent tilth and thus provides the best conditions for reduced working of the soil for main crops.

Sowing

Soil preparation/straw management

Rape sowing begins with the harvest of the prior crop. Important points in harvesting:

- cut stubble short
- chop straw finely (chopping lengths up to 5 cm)
- even distribution over the whole working width
- good chaff distribution

Whether or not a plough is used, the straw must not present further mechanical problems in the subsequent sowing, or, later on, cultivation problems (e.g. straw mats or insufficient recompaction. On non-cattle farms, straw is often the most important source of organic matter and is thus an important basis for active soil life and good soil structure. Intensive straw rotting will deprive any surviving pests in the straw of their nutritional requirements.

The larger the amount of straw and the shorter the time available, the more intensively and deeply the straw needs to be incorporated. As a rule of thumb, for each 10 dt/ha of straw a depth of 1.5 cm will be necessary.

Rape is a small seed and so must not be sown too deep. The optimum sowing depth is 2-3 cm.

Soil compaction must be avoided so the tap root can develop downwards undisturbed. Deep hoeing can be dispensed with if the soil structure is

adequate. In this case shallow working (10-15 cm) is sufficient in dry conditions.

Dry conditions during sowing are a big problem for quality of emergence and necessitate a water-conserving soil preparation in order to retain residual moisture in the soil and supply the seed with capillary water through a good recompaction. In damp conditions on the other hand, soil preparation should leave sufficiently large cavities for satisfactory oxygen supply to the roots.

The basic rule: Seed bed before sowing!

Sowing

In general the early and mid-season dates for sowing are preferable to late sowing. Early sowing with suitable varieties makes it possible to reduce sowing density and ensures healthy individual development of the plants. This can be beneficial especially in marginal locations, as the roots are able to penetrate earlier and deeper into the soil to reach the water-bearing layers. Thinner crops have better standability. However, there is a higher risk of winter damage if these early seedlings grow too vigorously (allow for growth control).

Sowing densities (viable grains/m^2):

Sowing date	Pure-line varieties		Hybrid varieties	
	Seed bed good	Seed bed poor	Seed bed good	Seed bed poor
to 15.08	40	50	30	40
15.08.–25.08.	50	65	40	50
from 25.08	65	90	50	60

Optimum sowing dates for all varieties are between 15 and 30 August, depending on region. Even the restored hybrids will give best results in this period, but because of their fast growth and vigour are more suitable for later sowing periods.

Late-sown rape has less time for pre-winter development. For this reason, the optimum starting conditions in the form of good soil and seed bed preparation and suitable sowing techniques are particularly important. However, late sowing is usually performed under difficult conditions following a prior crop of winter wheat, and with less than optimal seed bed preparation, due to time reasons.

Plant protection

Generally in rape cultivation, weed control must be accompanied by at least one further plant protection treatment in the autumn. Hence it would seem natural to combine growth control (at the 4-6 leaf stage, or when approx. 80% soil coverage is achieved) with micro-feeding and insecticide control.

Use of insecticides

In the first few weeks the young rape is sufficiently protected from cabbage stem flea beetle by the seed treatment. As the plant grows in size, the insecticide absorbed by the plant from the treatment is more widely dispersed and becomes increasingly ineffective, so from the 4-leaf stage at the latest checks must be made for pest attack.

Damage thresholds for pest control

Pest	Occurrence	Damage threshold
Cabbage stem flea beetle	Summer/autumn	Emergence up to 6-leaf stage: 10% of leaf surface damaged
	Summer/autumn	4-leaf to 6-leaf stage: 50 insects in 3 weeks per yellow trap
Rape stem weevil	February/April Most important rape pest! Flight on first warm spring days. Vital to detect further flights with yellow trap.	10-15 insects in 3 days per yellow trap
Pollen beetle	Early (buds concealed), from 6°C soil temperature	1-2 insects per plant
	Bud stage (shortly before start of flowering)	4-6 insects per plant
Cabbage seed weevil	Shortly before flowering	1 insect per plant
	During flowering	1 insect per 2 plants
Brassica pod midge	Minor seed weevil attack	3-4 midges per plant
	Critical seed weevil attack	1 midge per plant

Suitable insecticides such as FASTAC SC (alpha-cypermethrine) or KARATE ZEON (lambda-cyhalothrine) are available. The average costs of these products are relatively low. If there is also the potential for combined application, e.g. with a growth regulator/fungicide treatment or herbicide treatment, insecticide treatment will be worthwhile even when the problem of attack is relatively low.

Cabbage Stem Weevil
(Ceuthorhynchus napi)

Rape Stem Weevil
(Ceuthorhynchus quadridens)

Pollen Beetle
(Meligethes aeneus)

Cabbage Seed Weevil
(Ceuthorhynchus assimilis)

Brassica Pod Midge
(Dasineura brassicae)

Growth regulator/fungicide

Autumn application of growth regulator

Check of crop development at the end of September (40-60 plants/m^2).

Growth regulation with Triazolene (FOLICUR, CARAMBA) in autumn also provides a fungicide treatment, the effect of which on early Phoma infections should not be underestimated. As well as growth regulation, good nutrient application with potash and boron will increase winter hardiness.

Status	Parameter	Treatment
Normal	4 unfurled foliage leaves, root neck diameter 4 mm, healthy deep green, developed up to just before end of row.	no treatment necessary, in wet weather, allow for fungicides such as FOLICUR/CARAMBA (0.5-0.7 L/ha) against Phoma, or use fungicides without growth regulation effect.
too strong	more than 4 foliage leaves, root neck diameter over 5 mm, crop (row) closed, large, dark foliage.	Check growth of crop Use of a growth regulator (FOLICUR/CARAMBA (0.5 – 1.0 L/ha), second application may be necessary)
too weak	Fewer than 4 foliage leaves, root neck diameter under 4 mm, Crop is brightly coloured (red-violet), Crop unable to close up by mid October	Force crop on with N, possibly allow for FOLICUR/CARAMBA (0.3-0.5 L/ha) to improve winter hardiness, or use fungicide without growth regulator effect.

Spring use of growth regulator and fungicide

The aim of growth regulator in spring is to shorten the crop and thus improve standability. Also the dominance of the main shoot over the side shoots will be broken and the development of side shoots thus encouraged or their reduction avoided. This will lead to more

homogeneous flowering and a more even ripening. The optimum shoot shortening can be achieved when growth regulation is performed relatively early (20-40 cm plant height) or in the high-growth phases. Effects of lack of boron and sulphur will be aggravated by the use of growth regulator. As it is no longer allowed to add CCC, solo treatments with FOLICUR (tebuconazole) or CARAMBA (metconazole), depending on variety and crop development, have become common, with levels of between 0.5 and 1.5 L/ha (levels of 1.0 L and higher in splitting phase).

Cylindrosporium treatment may be carried out in the event of a spring attack in the phase end of rosette formation and start of elongation growth. Phoma should be combated as necessary after the conclusion of the leaf formation phase where this coincides with favourable infection conditions (attack on the lower leaves, temperatures over 10°C and precipitation). The optimum date for sclerotina treatment is usually the start of full flowering (50-60% of the rape in flower), when the first petals have already fallen. Besides the two azoles FOLICUR and CARAMBA, other products without growth-regulation effect, such as DEROSAL (Carbendazime), MIRAGE 45 EC (Prochloraz), ERIA (Diphenoconazole) or the newer CANTUS (Boscalide) are also suitable as fungicides (subject to permits).

Fertilisation

Rape makes high demands on the supply of nutrients. However, only part of these nutrients is removed in the seeds, so the majority remains at the disposal of the following crop. For this reason, from a crop rotation point of view the main fertilisation is best applied to the rape.

Basic nutrient supply to winter rape in kg/ha

Expected yield	40 – 50 dt/ha	30 – 40 dt/ha	dry locations
K_2O	250 – 300	200	
P_2O_5	100	80	
MgO	40	30	plus 10 %
S	40 - 50	30 - 40	plus 10 %(early)
Boron	0,3	0,3	plus 30 %
$MnSO_4$	1	1	double dose/application
Na-Molybdate	0,2 – 0,5		only for low pH values

N fertilisation in autumn

The use of nitrogen is chiefly aimed at encouraging straw rotting. Apart from this, N fertilisation is carried out on late sowings or in the case of unfavourable development conditions, e.g. wet or cold. Too high an N provision can lead to excessive growth and bolting, especially in early sowings. In this case an early intervention with growth regulator must be made. If the rape suffers from unfavourable growth conditions in September/October, the addition of micro-nutrients and bitter salt to a plant protection treatment in autumn can lead to a clear revitalisation and improvement of winter hardiness. If symptoms of N deficiency have already appeared in late autumn, an N application must be made at once in order to avoid reduction of yield organs. This also applies to stands with excessive growth.

N fertilisation in spring

The high requirements of rape at the start of vegetation must be covered by the first N application. 80-120 kg N/ha will be sufficient. Normal and well developed crops will have taken up 40-100 kg N/ha before the

winter. Lush, well-fed crops should not be over-stimulated and fertilised too early, in order not to encourage new leaves at the expense of side shoots. Weakly developed crops on the other hand need to develop biomass as quickly as possible and thus need an early first N application with a proportion of quick-acting fertiliser forms.
The second N application will be made after the start of elongation growth, around the beginning of April.

Decision criteria for N fertilisation

Plant development	Winter	N distribution		Date of 1st N application
		Application 1	Application 2	
Strong	Mild	40%	60%	Delayed
Strong	Hard	60%	40%	Delayed
Weak	Mild	70%	30%	Early
Weak	Hard	75%	25%	Early

The basic guideline for yields of 35-40 dt/ha is around 200-240 kg N/h, corresponding to approx. 5-6 kg N/dt yield. The fertilisation requirement in spring will be less the nitrogen content of the soil (N-min) and any autumn applications.

Sulphur (S)

Sulphur requirements must be met before elongation growth starts. Lack of sulphur will show up in the younger leaves, which will take on a yellow marbled appearance. Flowers will be smaller and will be pale yellow to almost white. A high N fertilisation will exaggerate this deficiency. A lack of sulphur, as with boron, will limit both the number of pods/plant and the number of seeds/pod.

Sulphur fertilisation of approx. 30-40 kg/ha will usually be sufficient. Basic sulphur supply can only be guaranteed by soil fertilisation. As a defence against reduction in further plant development, leaf fertilisation with sulphur and micro-nutrients can be tried.

Other nutrients

Optimum pH values for rape cultivation in clayey sand are around 6, in sandy clay 6.5 and in clay soils 7. Sufficient quantities of sulphur and magnesium are essential for rape. The pH value is primarily controlled by calcium provision, which thus simultaneously covers the plant's calcium needs. With regard to micro-nutrients, leaf fertilisation with boron in the spring is a must, while manganese and molybdenum should be considered. Where no fertilisation with commercial products is used, the rape crop should be leaf-fertilised (from shoot development to blossom) with boron, manganese, molybdenum and the other trace nutrients of copper, iron and zinc. A combination with an insecticide treatment or growth regulator should be considered here.

Harvesting

Desiccation to accelerate ripening

Desiccation will entail further application and product costs. There will also be losses round the tractor tracks. Desiccation is thus only justified in exceptional cases, when strong second growth or heavy weed infestation (e.g. cleavers or camomile) would lead to harvesting difficulties.

To accelerate harvesting, Diquat-containing products (e.g. 2.0 L/ha REGLONE) can be used if the first grains are already black and the

grains in the middle area of the main shoot are reddish-brown to dark-brown (all pods yellowish). About 7-10 days later threshing ripeness is reached.

The amount of water used must never be set too low, but must be at least 400 L/ha. The aim is to hit all green plant parts if possible. For this a deep penetration of the crop is necessary. Equally, the addition of a wetting agent is beneficial. Application is best performed in the early morning hours on dew-wet crops (but not before rain). If wetting is insufficient, desiccation can even have negative consequences: The upper pods are hit and mature quicker while the lower pods are not wetted and, as with the stems, remain green – ripening is thus staggered.

Rape harvesting techniques

There are two basic harvesting systems:

- Swath harvesting with pick-up
- Combine harvesting with rape cutter

Swath harvesting:

Continued ripening in the swath ensures that all seeds are ripe at the same time when threshing takes place. Swath harvesting has strongly declined in favour of combine harvesting due to the higher costs. Only in extremely windy areas, e.g. along the coasts, has swath harvesting a continued importance. It also has advantages in uneven crops, e.g. near woodland, in hollows and in cases of heavy weed infestation. Unlike summer rape harvesting, where swath harvesting is mainly used to shorten the ripening time, this argument plays no role in winter rape cultivation. For this reason, swath harvesting of winter rape has almost vanished, apart from specific regions.
Swathing should be performed only when the seeds take on a brown coloration, when the water content of the seeds is around 30%. The earliest point will be yellow ripening, when the seeds are pale yellow in colour with reddish-brown sides and no longer split into two halves when rubbed. Early swath dates bring with them significant yield losses. Thousand kernel weight does not achieve its maximum until the time of combine harvesting ripeness, so swathing always entails giving up a certain amount of natural yield increase. The latest date is when the grains are brownish-red with black sides. The swath should lie soil-free on high stubble (20-30 cm) if possible. In good weather the drying and

continued ripening time will be 6-10 days. The swath should be collected with a pick-up. Undercutting of the swath with crop lifters on the cutting knife will only work where the stubble has a uniform height and poses the risk of high losses.

Combine harvesting:

The combine harvesting of rape is now the standard procedure. For this both side blades and cutter extensions are usual, allowing harvesting losses to be reduced by up to 90%. The extensions mean that the rape pods are already on the table when the stem is passing through the feed auger. The longer the rape, the sooner this will happen. In this, stubble height naturally plays a large role. Most losses occur in the area of the side blades. At least one side should be fitted with blades which are angled slightly backwards. To reduce losses the lowest possible reel speed on the combine must be selected along with a brisk forward speed.

Compared to swath harvesting, combine harvesting achieves oil contents some 1-2% higher, due to the longer, natural ripening, and where efforts are made to avoid harvesting losses it will also give higher yields. The harvesting date is hard to determine and is usually set too early. Rape not only has a flowering phase of three to four weeks, but in the same way also ripens over a rather staggered period. The optimum maturity date will occur when the first pods on the main shoot are already splitting

open. At this point later pods have finished ripening even on lower side shoots and the stem has also dried out more. Threshing ripeness occurs when approx. 12-13% moisture is reached. However, as rape can only be stored at 8-9%, this will involve drying costs. Lower humidity levels will reduce drying costs, but increase the risk of failed harvest. During the threshing procedure a remoistening of the seeds by 2-5% may occur due to green stems and heavy weed infestation (camomile!). For this reason, and also to increase machine performance, the cutting height should be set as high as possible.

Combine harvester adjustment for rape

Working components	Crop conditions		
	Dry	Medium	Damp
Drum speed (rpm) for drum diameter **Ø 450 mm** **Ø 600-610 mm** **Rotor speed**	 **600 - 700** **400 - 500** **340 - 450**	 **700 - 800** **500 - 600** **450 - 550**	 **800 - 900** **600 - 700** **550 - 650**
Concave inlet (mm) **Concave exit (mm)**	**32 - 29** **25 - 22**	**29 - 26** **23 - 20**	**26 - 24** **21 - 19**
Upper sieve (mm) **Extension (mm)** **Lower sieve (mm)**	**5 - 7** **6 - 7** **Or close** **2 - 4**	**6 - 8** **7 - 8** **Or close** **4 - 5**	**7 - 9** **8 - 9** **Or close** **5 - 7**
Fan (rpm)	**Low**	**Low**	**Low**

Source: Feiffer Consult 2001

Advantages of combine harvesting

- higher yield due to lower losses
- elimination of one working process
- after rain the rape dries more quickly on the stalk.

Disadvantages of combine harvesting

- Harvesting time approx. 1 week later, giving sharper work peaks, and possibly ripening overlaps with wheat
- The rape is 3-4% moister and less clean due to non-uniform ripening.
- special cutter necessary
- Risk of failure in standing rape due to wind.

HEADER-EXTENSION

Avoid high losses with harvesting your rapeseed by using a header extension.

Header extension and side knives / separators help to reduce harvest losses and to increase your yields.

Please pick up your information directly with the manufacturer:

www.biso.at

www.ziegler-gmbh.com/cms/ziegler_web.nsf/id/pa_rapstrenner2_zld.html

www.zuern.de

Selection of the variety

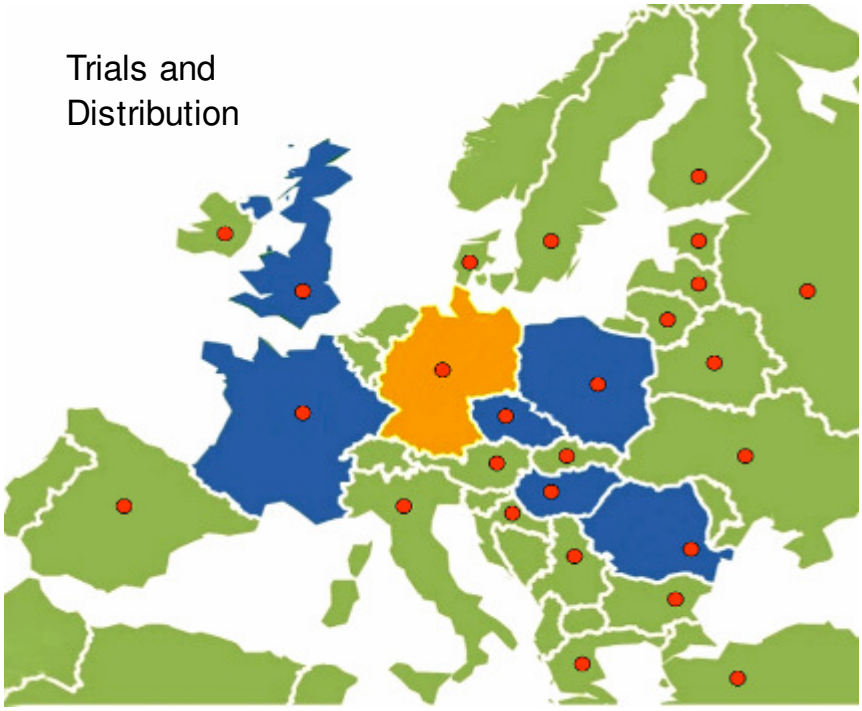
The main thing of the cultivation decision is primarily the variety and its suitability for the location. However the sowing date and sowing density are also definite, irreversible factors for the new rape crop.

While the sowing window is around 4 weeks, the harvesting window is much narrower. As a rule the difference in ripening between an early maturing and a late variety is approximately one week. Especially on large farms, it is worthwhile taking the variety-specific maturity differences into consideration when organising the combine harvest operation.

From the breeding point of view a distinction can be made between pure-line varieties and hybrid varieties. In both segments breeding offers numerous varieties with very different characteristics. The farmer must therefore base his variety decisions on his individual requirements and the performance profile of the variety. The hybrids tend to be stronger and quicker-growing, and so are excellent for sowing with reduced soil preparation and for later sowing dates. The yield of hybrids is superior to the pure-line varieties by approx. 10%.

There is no universal variety suitable for every location or challenge of rape cultivation. The task facing the farmer is to divide rape cultivation between several suitable varieties and to find the best production techniques for each variety.

Trials and
Distribution



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