

TECHNOLOGICAL REQUIREMENTS FOR GROWING WINTER OILSEED RAPE

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ABSTRACT

Winter oilseed rape (also called oil-yielding rapeseed) has a significant share in the crop rotation of Bulgarian farms alongside traditionally grown cereal crops and oil-yielding plants. This paper examines some technological requirements which have real importance for the successful growing of this crop because they ensure the optimal conditions to enhance yields and to improve the quality of the seeds that are grown.

INTRODUCTION

Rapeseed belongs to the Brassicaceae Family and the Brassica Genus. It is grown for its seeds because they are rich in fats, proteins and carbohydrates. Rape seeds contain from 30% to 49% of fats, up to 20% of proteins and more than 17% of carbohydrates. This is the reason why they are considered to be a valuable raw material for the production of vegetable oils and bio fuels. Due to the high profitability and the favourable agrometeorological conditions in this country the area of the fields dedicated to winter oil-yielding rapeseed is growing and rapeseed's share in the crop rotation of Bulgarian farms is equal to the share of the traditionally grown cereals and oil-yielding crops.

Using knowledge about the most significant requirements for growing this important crop in contemporary agriculture in Bulgaria and making the right choice concerning the conditions for growing, the most suitable technology could be selected to grow rapeseed successfully. There are some technological requirements which play a vital role in each particular technology alongside the climate requirements and the requirements towards the soil.

This paper aims at pointing out those technological requirements that create the optimal conditions for enhancing the yields and improving the quality of the rape seeds that are produced. It also aims at helping Bulgarian farmers and agricultural producers enrich their knowledge in agricultural technology.

THESIS

The specific technological requirements that are of real importance to the production of oilseed rape may be presented and justified in the order of the technological operations for which they apply. These technological operations include: the choice of preceding crop, application of fertilizers, tillage of soil, sowing and operations during vegetation.

Requirements towards the preceding crop

Oilseed rape is not very demanding as regards preceding crops. Its requirements are determined by the need to ensure enough time to prepare the soil properly. Therefore the preceding crops could be divided into two groups:

favourable – winter wheat, winter barley, triticale, oats, rye, peas, wheat grown for fodder;

unfavourable – oilseed rape, sunflower, soya, beans, white and black mustard.

It is not recommended to sow oilseed rape consecutively. It should be sown with an interval of at least 3 to 5 years and in the case of contamination with *Sclerotinia Sclerotiorum* the interval should be at least 7 years. Moreover fields that have been treated with herbicides which have a long lasting effect should be avoided because oilseed rape is especially sensitive to them.

Requirements towards the application of fertilizers

Winter oilseed rape is very demanding as regards the nutritious substances in the soil. It responds well to both organic and mineral fertilizers. The need for nutritious substances is often met by applying artificial fertilizers. The following amounts of fertilizers are considered to be the optimal for the specific conditions in Bulgaria: N - 180 – 200 kg/ha, P_2O_5 , 80 – 150 kg/ha и K_2O 50 – 100 kg/ha.

The schedule for fertilizer application should be made for every particular field though. It should be based on an agrochemical analysis of the soil bearing in mind the target for the yield from the crop.

It is recommended that nitrogen be introduced two times – 20% in autumn and 80% in spring. Some people argue that under normal conditions rapeseed does not need nitrogen treatment in autumn since an intake of nitrogen at that time will make the plants grow very quickly and thus increase the risk of being destroyed by frost in winter. On the other hand it is a well known fact that at the end of winter a good rapeseed crop should have a mass of at least 500 – 600 g/m^2 (fresh substance) over the ground so that it has a good start in spring. To achieve this mass plants need 35-45 kg of nitrogen per hectare.

The spring treatment can be performed in two stages: 40% early in spring in February or at the beginning of March and 60% when the buds begin to form.

Phosphorus and potassium unlike nitrogen are introduced into the soil wholly in autumn when the main tilling of the soil takes place. Both of them are important nutrients for oilseed rape. Phosphorus stimulates the growth of the root and the formation of the seeds and enhances the resilience of the plant and improves ripening and potassium plays a major role in keeping the plant from freezing, withstanding drought and preventing diseases.

Oilseed rape responds well to the treatment with trace elements such as: sulphur, manganese, boron, magnesium, molybdenum, zinc, etc.

The need of rapeseed for sulphur is great and is closely connected to the assimilation of nitrogen. Insufficiency of sulphur leads to an increase in the risk of diseases, it causes a decrease in yields and a reduction of the oil content.

In cases when an insufficiency of sulphur is possible 50-80 kg/ha of SO_3 should be introduced into the soil early in spring.

To have the growth of leaves stimulated oilseed rape needs 40-60 kg/ha of MgO introduced before sowing.

It is recommended that a treatment with boron is performed applying 0.7 - 1.5 kg/ha. This should be done together with a treatment with fungicides, growth stimulators, etc. so that a better viability and frost resistance is achieved as well as a better start in spring.

Introducing manganese helps the synthesis of proteins and photosynthesis in oilseed rape. An amount of 9 kg/ha of $MnSO_4$ will lead to a better condition of the rape crop.

Requirements towards the cultivation of the soil

The cultivation of the soil is one of the most important stages in the growing of rapeseed. It is a prerequisite for the good quality of the sowing, the proper development of the crop and the achievement of high yields.

Therefore the preparation should be done in such a way as to provide a crumbly surface layer free of lumps or weeds so that it serves as a solid bed for the crop and is able to keep the moisture of the soil. For the optimal conditions of the soil to be reached efforts should be made as early as the harvesting of the previous crop which is wheat in most cases. On fields that are allocated to be sown with oilseed rape there should not be a great amount of straw left.

The method of cultivation depends on the condition of the soil, the previous crop and the time available for sowing.

Depending on the condition of the soil the following ways of cultivation are possible:

- if the soil is extremely dry, tilling should be carried out immediately after the harvesting at a depth that corresponds to the moisture content. On the whole, cultivation should be shallow postponing the deeper cultivation until the first rain falls.

- if the soil is extremely moist, a greater number of cultivations should be carried out at a smaller depth especially with heavy soils. Rolling should be excluded from the technological cycle of operations.

- under normal conditions all kinds of cultivation that have been planned can be carried out according to the available equipment and the type of the soil.

In the case of grain crops preceding the sowing of rape the most suitable cultivation for Bulgaria is ploughing-in the stubble immediately after the harvesting at a depth of 6 cm carried out by disc harrows followed by ploughing at a depth of 20-25 cm. Ploughing can be carried out by ploughs equipped with lump-breakers or spike-tooth harrows. Until sowing is carried out the soil should be kept free of weeds by cultivation at a depth of 8-10 cm. Immediately before sowing the field should be treated with a Rau combi cultivator to prepare a hard bed for sowing which is necessary for the tiny rapeseed seeds.

It is known that the quality of the seedbed is even more important than the time of sowing. If the interval of time between the harvesting of the previous crop and the sowing of the current crop is not very long and the field is free from weeds, it is a good idea to cultivate the soil with a disc harrow twice at a depth of 10-12 cm. Later the soil should be cultivated once again using a disc harrow at a depth of 8 cm so that it looks like the soil in a garden. Before sowing, the field should be rolled using smooth or combined rollers.

Another version of the soil preparation in cases when the previous crop is harvested late or in cases of drought is to use elements of ploughless cultivation. This version includes cultivation with a disc harrow at a depth of 4-6 cm immediately after the harvesting followed by tilling with chisel cultivators or scarifiers. Immediately before sowing, cultivation at a depth of 20-25 cm is performed followed by rolling.

Requirements towards sowing

The time for sowing is vital for the growth of rapeseed in autumn. It should be chosen so that plenty of time is ensured for the plant to reach a phase of development that is characterized by 8 – 10 leaves. Thus the plants will endure winter in a good condition. The optimal term for sowing in Bulgaria is from August 30th to September 20th. It is also possible to carry out the sowing from August 15th to September 30th. Within these time limits it should be borne in mind that in places with a higher altitude, sowing should take place earlier while in plains and southern regions sowing should be performed later.

Rape is a crop having very small seeds and this is the reason why it has very high requirements towards the seedbed. The seedbed should be well cultivated so that it becomes flat and even. The soil should have a fine crumb-like structure to ensure enough moisture for the seeds to germinate.

Oilseed rape is sown using pneumatic or ordinary seed-drills designed for cereal crops. Combined machines could also be used such as active harrows and clod-breakers, rollers and seed-drills aggregated to suitable tractors.

The depth of sowing should be 2 – 4 cm depending on the moisture in the soil and the quality of the seedbed. Rolling should be performed before sowing to ensure the seeds germinate simultaneously after they have been sown at the optimal depth. Rolling could be performed immediately after sowing as well. Thus the contact of the seeds with the soil is improved and the transfer of moisture via the capillaries in the area of the seed is enhanced.

The amount of seeds to be used depends on the specific technology for growing of rapeseed. It is recommended to use 4-9 kg per hectare for most of the contemporary varieties and hybrids. The aim is to achieve 30 - 40 plants per square metre until the end of winter. If the crop grows very dense, it might lean sideways since the plants are rather long.

Requirements towards care during vegetation

These requirements involve keeping the fields free of weeds and fighting diseases and pests efficiently.

The optimal preparation of the soil and the good seedbed reduce the growth of weeds, accelerate the growth of the rapeseed plants and generally improve the vitality of the crop and its potential to outgrow the weeds. It could be said that rapeseed and weeds compete for the utilization of the moisture in the soil, for assimilation of the nutrients and for the light that comes from the sun. Application of herbicides reduces the growth of weeds and the losses in yields. Introducing herbicides into the soil is more often than not performed before the plants have come up at the early stages of the development of rapeseed. The following herbicides are the most widely used in the growing of oilseed rape and are allowed for use as well:

- For annual cereals, some deciduous weeds and self-sown wildings - Agrifilan 24 EK (350 ml/da) and Dervinol 4F – 300-350 ml/da, introduced at the time of sowing by incorporation;
- For annual cereals and self-sown wildings - Fusilad super - (150 ml/da), introduced during vegetation;
- For perennial weeds and Sorghum Halepense – Fusilad super (200 ml/da);

- For deciduous weeds and volunteer cereals – Butizan 400CK (400 ml/da c 25-30 L/da working solution). It does not affect rapeseed. It is introduced immediately after sowing before the plants come out or at the stage when weeds have formed their second leaf. Butizan S (300-250 ml/da) could also be used. It should be introduced after sowing before the sprouting of the crop;
- For annual deciduous weeds – Sultan 50CK (240 ml/da), introduced after sowing before the sprouting of the crop.

Because of the comparatively dry climate in Bulgaria, in general, diseases do not cause very significant damage to rapeseed crops. In spite of this fact, farmers should have enough information about the following common diseases that are caused by: *Phoma lingam*, *Sclerotinia sclerotiorum* and *Alternaria brassicae*.

Black leg disease or stem canker (*Phoma lingam*) is a disease caused by a fungus. This disease can affect all organs of the rape plant but it affects the leaves and the stem mostly. The first symptoms appear as light beige spots on the leaves and later black spots called pycnidia also appear. The damage caused by this disease in autumn leads to rotting and breaking of the stem in spring. Losses in yields can amount to 25% – 100% of the whole crop. If the crops are infected with this disease, it is obligatory to treat them with a fungicide in autumn. The following fungicides are suitable: Toprex 375 CK in a dose of 30-50 ml/da, Cuprocyn - 0,4%, Digan M45 – 0,2%, etc. It is too late to apply these fungicides in spring.

White mold caused by *Sclerotinia sclerotiorum* is another plant fungal disease. It affects the stems and the generative organs of the oilseed rape. The infected plants start to change colour and become yellow and they also wither. If the weather is wet the damaged parts of the plant are covered with white fuzzy growths of mycelium where sclerotia are formed. At the base of the stem the tissue becomes brown and rots and the plant breaks. This disease can be prevented if Tebuconazole and other fungicides containing boscalid are used in a dose of 50-70 ml/da at the stage of full blossom.

Alternaria brassicae causes an infectious disease on oilseed rape. In practice it is known to affect the pods and lead to losses due to the early splitting of the pods. But it can affect plants in all stages of their development and it can damage all their organs (excluding the root). The disease is characterized by the formation of small brownish spots which become larger as time passes. These large spots are brown and black in colour and in the middle of the spot the colour is lighter. Using Tebuconazole and other fungicides containing boscalid in a dose of 50-70 ml/da at the stage of full blossom can prevent the disease. If the illness develops Digan M45 – 0,2% should be used. A sticking substance such as Universal 50-0,05% or Elo should be added.

Winter oilseed rape is attacked by many pests at different stages of its development.

Pest control by applying insecticides (such as Kreitzer – rapeseed 332 FC) prevents plants up to the stage of development when the plant has 3-4 leaves. After that pest control should be directed to flea beetles, cabbage stem flea beetles, autumn aphids, pollen beetles, seed weevils, pod midges and mealy cabbage aphids.

The following insecticides are suitable for pest control in oilseed rape growing: Actelic 50EK, Dursban 4E, Regent 800BG, TOM-bel 32EK, Padan 50VP, Pilot 48EK, Karate-Zeon, etc.

The most difficult stage in pest control takes place in the phenophases of blossoming and ripening when pollinators especially honey bees should be kept safe.

Therefore at this stage it is recommended to use pyrethroids : Vaztack 10EK in a dose of 12,5-15 ml/da, Karate Gold 12,5-20 ml/da, Bankol 50ПВ-150 g/da, Rodeo 50BП -150 g/da, Karate Zeon 15 ml/da etc. These insecticides can fight the following pests: The Pollen beetle (if 1-2 beetles can be found on a single plant), the Cabbage stem flea beetle (even when it is a fully grown insect), Flea beetles and some others very efficiently.

To achieve a good pollination of oilseed rape it is a good idea to put some beehives near the field - two beehives per each decare of crop.

CONCLUSION

Finally, the following conclusion could be drawn: the above mentioned technological requirements towards the production of oilseed rape are of real importance in the successful growing of this crop. If they are properly applied, optimal conditions for increasing the yields and improving the quality of the seeds can be achieved.

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