POOR OILSEED RAPE YIELDS

What are the causes?

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Winter rape cultivation over the last 45 years has been a success story on a par with breeding developments in maize and sugar beet. A crop born of necessity during wartime has been transformed into a sought-after oil crop by breeding out the erucic acids and glucosinolates. At the same time, the yields of modern hybrid winter rape varieties have been increasing at a rate that cereal growers can only dream of. This year, however, many farmers have been disappointed by the yields. What's the reason for this decline?

Nature does not produce constituents without good reason: Erucic acids and glucosinolates repel insects and, to a certain extent, act as a fungicide. Without these substances, the 'double zero' varieties provide a tasty treat for pests. This shortcoming is not a major problem, provided that the rape seed can be treated with effective insecticides.

Absence of seed coating

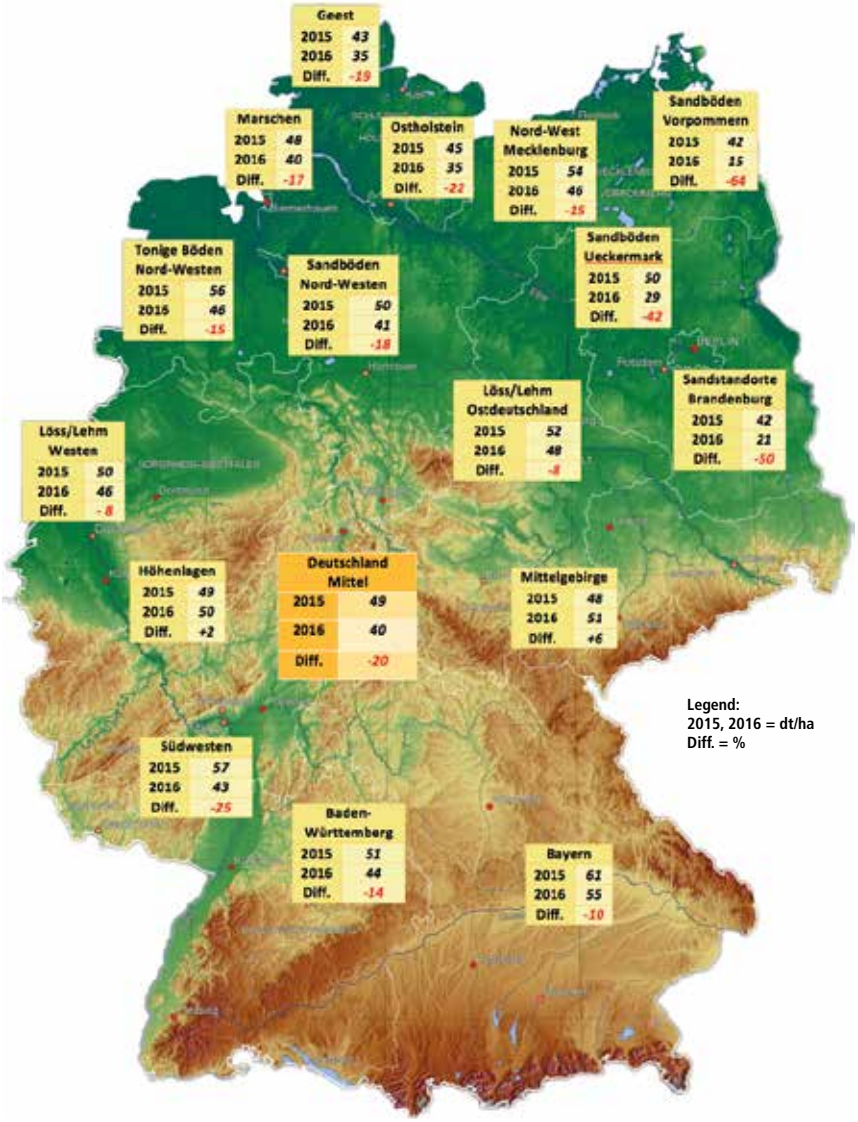
But for the past two years, the ‚double zero' varieties have been grown for the first time without benefiting from an insecticidal coating. The oilseed rape crop was largely able to withstand chewing and boring damage caused by cabbage root flies and cabbage flea beetle larvae thanks to the almost perfect weather conditions. Nevertheless, yield losses of 0.4 to 1.2 t/ha were reported. Overall pest pressure last autumn was not high enough to cause serious direct damage. However, chewing damage on the roots and holes around the crown and below the stem area encouraged root crown and stem diseases and water penetration, subsequently leading to massive crop failures in the north-east. Unlike in previous years, the damaged oilseed rape plants were unable to recover due to the cold snap in March which prolonged dormancy and delayed regeneration this year. Whilst in previous years in the north-east 4 or even almost 5 t/ha had been harvested, oilseed rape yields this year crashed to between 1.5 (!) and 2.5 t/ha. This fall cannot be attributed to the effects of frost or subsequent drought alone. Oilseed rape yields in the rest of Germany were also disappointing. Even in the south, harvests were down by between 0.5 and 1.0 t/ha (Fig. 1). In regional varietal trials carried out in the eastern part of the Federal State of Schleswig-Holstein, yields fell by 0.9 t/ha compared with the previous year and by as much as 1.4 t/ha compared with 2014, a decline of 25 %. Yields were also down by 20 to 25 % compared with the previous year in regional varietal trials in the west of Germany (Hessen, North Rhine Westphalia, Lower Saxony), where winter-kill and drought played only a minor role. France experienced even more severe yield losses. Only upland areas recorded higher oilseed rape yields than in previous years. Late sowings (from 10 September) also did comparatively well. This provides a clue to the main cause of the yield losses, since upland areas in the west and in the east clearly benefited from the mild autumn weather.

What lies behind these yield losses?

1. Oilseed rape drilling did not take place in ideal conditions due to widespread wet weather in summer. This adversely affected root growth.

2. Nevertheless, despite normal drilling times, the oilseed rape put on too much leafy growth last autumn. However, as a brassica, in autumn it produced more vegetation than subsequent seeds.

Abb. 1: Comparison of oilseed rape yields in 2015 and 2016 based on regional varietal trials and farm data



Rape crops which germinated on 1 September received an accumulated thermal time of 1200 °C days until the frost in January, an increase of 120 °C days compared with the previous year (2015) and as much as 300 °C days more than the long-term average. This was due mainly to the higher temperatures in November and December. However, in the last three months of the year, the oilseed rape had to make do with less than 70% of the sunshine recorded the previous year. As a result, the rape plants may have produced fewer cytokines in proportion to plant mass – especially in areas that received more than 150 mm of rainfall in November and December – causing the fine roots to break down. Consequently, although the oilseed rape plants produced plenty of leaf mass and few buds developed on the main shoots. The plants then had difficulty setting more than 50 pods on the main shoot; an essential requirement for high yields. The side buds in the leaf axils were also comparatively poorly developed in the plants, now considered old in physiological terms.

3. Active growth continued in December right up to Christmas, preventing the oilseed rape plants from hardening. In the first days of January temperatures plummeted, e.g. from 14 °C (28 December) to – 16 °C (2 January) in Neubrandenburg. Where the oilseed rape was protected by a covering of snow, it remained largely undamaged. The lush leaf growth also protected the shoots, raising hopes that the rape would survive the frost intact apart from leaf loss. After all, this is what happened in 2011. But with the root crown peppered with pest damage, the plants didn't stand a chance.

4. Vegetative growth did not resume until the end of March as day length increased. With the lengthening days, the plants were compelled to rapidly elongate the shoot axis, as a result of which the lower side branches fell by the wayside. This was clearly visible in the rape canopy: The stems were not as densely packed with pods as they had been in previous years.

Ground frost led to crop failures ranging from 30 to 70%.

5. The first oilseed rape crops had already started flowering by the second or third week in April. But the characteristic smell of oilseed rape was noticeably absent: Although the (female) flowers were ready to pollinate, there was still no pollen around. So the unfertilised early flowers withered at the base of the main shoot.

6. Then came the 17 April: For a whole week, night-time temperatures plummeted to freezing and even down to – 6 °C in some areas, whilst daytime temperatures struggled to reach 10 °C. It wasn't generally frosty enough to freeze the buds and leaves to a significant degree. Nevertheless, the low temperatures adversely affected the viability and mobility of the pollen, and thus of pollination. Furthermore, they inhibited cell division (meiosis) in the fertilised embryos, thus arresting their development. The oilseed rape produced smaller amounts of particularly weak pollen, which had an adverse effect on fertilisation. Furthermore, the rate of cell division in the fertilised embryos was too slow, causing them to shrivel. As a result, there were fewer seeds in the pods. This was particularly noticeable when the pods were held up to the light. Although the pods were the usual length, there were dints in them indicating the missing seeds. Instead of 24 seeds per pod, there were often just 12 or 14, sometimes even fewer. Pure-line varieties proved more robust than hybrid varieties when it came to seed formation.

Low temperatures in April adversely affected the viability and mobility of the pollen.

Thus pure-line varieties did comparatively well this year in terms of yield. Low pollen production in oilseed rape is also the main reason for the poor honey harvest this year, along with the fact that the fruit trees that blossom at this time of year also produced less pollen due to the weather.

7. In the north-east the drought in May prevented the seeds inside the pods from bulking up to compensate for the shortage of seeds. In the west, a lack of sunshine from late May until mid-June had a similar effect. Net assimilation was therefore significantly lower, leading to a below-average test weight.

8. Last but not least, when temperatures soared to over 35 °C for a few days in early July, hopes for above-average seed growth were finally dashed. The hot weather caused the rape to ripen suddenly, preventing the TGW making up for the underfilled pods. Although the seeds were ripe, the stems were often still green. This meant that the oil content also fell short of expectations.

The cold spell in mid-October stimulated the sclerotia to germinate.

Impact of disease

The weather has a direct impact on plant growth, but it also indirectly affects the incidence of disease, and the plant's response to it. With the exception of verticillium, severe yield losses as a result of disease can be limited by varietal selection and the use of fungicides. The wet weather in August provided the ideal conditions for phoma infections in adjacent volunteer oilseed rape. The dry spell in September prevented the phoma spreading to freshly emerged oilseed rape plants. Then in October it was initially too cold for the infection to thrive and later the pathogen was significantly less virulent. As a result, phoma root rot on a scale that affects yields occurred only sporadically. On the other hand, the wet weather in mid-August and high soil temperatures in autumn favoured the spread of club root. Indeed, club root occurred even in areas where it had not previously been a problem. Varietal trials in which club root-resistant varieties (e.g. Mentor) were tested as well and ranked at the top of the range are a good indicator of club root-resistance. Club root has increased dramatically as a result of growing brassicas for greening purposes. The combination of damp soil, high temperatures and pest damage in the roots favours the spread of verticillium. When oilseed rape roots turn black and can easily be pulled out of the soil, verticillium is the most likely cause. If on the other hand the stem snaps off above the crown when the stubble is pulled, phoma root rot will be the main suspect.

The cold snap in October last year followed by mild, damp weather led to an outbreak of the fungal infection sclerotinia in autumn, especially in upland areas. The cold weather in mid-October stimulated the sclerotinia to germinate; in November/December (as the days got shorter) it produced mycelia which infected the root crown. This infection led to the formation of sclerotia immediately above the root crown. Dressing with calcium cyanamide (at the time of drilling) or a later application of azole (with Toprex, which also acts via the soil) in late October to mid-November prevented this attack. This fungal infection resulted in yield losses ranging from 0.5 to 0.8 t/ha. A later outbreak of sclerotinia then occurred in conjunction with the heavy rainfall in the third week of May when the oilseed rape was still in flower. In most cases, the flowering crops were sprayed in the last days of April. The effect lasted for a maximum of 3 weeks, which meant that most of the crops no longer had fungicidal protection when the outbreak occurred. Furthermore, there was a growing body of evidence to suggest that strobilurins (Azoxystrobin) no longer provide sufficient protection against sclerotinia.

Verticillium: Black spore bodies under the epidermis

Conclusion

Let's try to assess the parameters that influence yield levels. Our oilseed rape varieties have a yield potential of 9 t/ha.

- The ‚old plants' lost around 20 % of their performance, reducing yields from 9 t/ha to 7.2 t/ha.
- The pod set was at least 10 to 15 % down, so theoretically it was still possible to achieve 6.0 to 6.5 t/ha.
- The pods contained between 10 and 20 % fewer seeds. So a maximum of 5 to 6 t/ha could still be harvested.
- Poor seed development reduced the thousand-seed weight by a further 10 to 15 %, leaving a harvest of between 4.5 and 5.5 t/ha that could still be harvested this year if everything else went smoothly.
- Ground frosts were then responsible for crop failures of between 30 and 70 %, with the late start to the growing season preventing recovery.

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