How healthy are the roots of your oilseed rape stands? Horizontal roots should never be longer than the main root.

WHAT ARE THE TIPPING POINTS IN OILSEED RAPE GROWTH?

A CRITICAL LOOK AT TILLAGE PRACTICES IN OILSEED RAPE

A critical look at the quality of a soil usually raises questions about the tillage practices and the optimal stubble management. After all, crops like oilseed rape are very vulnerable to any agronomic failings. Are a large number of lateral roots originating from the taproot an alarming sign? Which chop lengths ensure perfect incorporation? We should also discuss whether physical soil data can help predict and prevent inadequate root development and reveal how stubble length affects the quality of incorporation.

In no other crop is a good development in autumn as important as in oilseed rape, because a poor development of this crop suggests a reduced yield potential in the first place. Maximising yield potentials requires growers to adopt appropriate tillage practices and pursue an ideal stubble management and also sow when conditions are right.

Know the demands of oilseed rape on soil cultivation

Oilseed rape develops quickly in well-aerated topsoils which are characterised by a large number of air pores. These pores are created by earthworms or by intensive mixing also by the plough. Another important aspect is the nutrient mobilising effect that intensive cultivation has on the soil. After all, oilseed rape has a high nutrient requirement in autumn. Further on, a good seed-to-soil contact is important for these small-grained seeds to emerge quickly. This means, the cultivation pass should create a good tilth that is free of coarse and long ends of biomass. After all, these are often an issue when cropping intervals are short with only little time for rotting. Then the large chops will hamper emergence and block the access to the capillary water. In very poor rotting conditions – for example wet straw that was ploughed in – we observe the formation of oxalic acids which affect root growth. As a rule of thumb, 70% of the straw should be chopped to less than 4cm lengths and the chopping knives should be sharp and replaced after 200ha at the latest. Also, combine operators should verify that the straw and chaff are distributed properly. After all, in a field yielding 80-90dt/ha* of straw as much as 160-180dt/ha* of the material will accumulate in the overlapping strips – to the effect that field emergence of the following oilseed rape is seriously hampered.

Tillage practices and root formation

In ploughed and suitably consolidated soil oilseed rape can form a nice root – ideally in the typical radish form. The new and much discussed strip tillage system enables the plants to develop roots that look at least as the one shown in photo 1. The roots look different in soils that were not ploughed. In minimal tillage, for example, where only the topsoil is cultivated the oilseed rape root tends to develop a large number of horizontal roots (photo 2). This shouldn't be a problem, provided the

* 1dt is the equivalent to 100kg

lateral roots are not longer than the main root. Fields that haven't been ploughed for a number of years have a much larger earthworm population than ploughed land and as a result we find a larger number of roots in the subsoil. In fields that received one straw incorporation and no deep soiling pass, we find a larger number of horizontal roots originating from the taproot. Photo 3 shows an oilseed plant from a field that received one 5cm deep cultivation pass. This taproot is developed very poorly.

» SPECIAL ATTENTION SHOULD GO TO THE STRAW CHOPS, ESPECIALLY IN SHORT INTERVALS BETWEEN TWO CROPS, SUCH AS OILSEED RAPE FOLLOWING WHEAT. «

Marco Schneider

Measurements

Extensive measurements are helpful to relate the various shapes of roots to the air capacity of the soil. For this purpose, a tillage trial was set up in a field of red sandstone weathered soil classified as light soil of 7% clay, 28% silt and 65% sand. The trial plots were submitted to four different cultivation schemes: ploughing, one deep soiling pass at 18-20cm, one minimal tillage pass at 5cm, and one striptill scheme. Air capacity describes the presence of air pores. The large pores are particularly important for oilseed rape which requires large amounts of air, with 5 volume percent being considered the minimum limit. Figure 1 shows that the air capacity was higher in the intensively loosened soils. The topsoil in the ploughed plot was even found to be excessively loosened (see Fig. 1; turquoise). Deep soiling shows the most consistent tillage results not only in the topsoil but also in the transition zone to the subsoil (light green). The single and shallow discing pass (light blue) produces results that are considered poor (light blue), because air capacity is so low that it starts causing damage to the crop (red line). In this plot which received a shallow cultivation pass, the researchers found the most poorly developed roots. The loosened strips of the striptill plot produced almost the same results as the ploughed land (grey) although the cultivator tines created a pan that accounted for a sharp drop in air capacity. The situation is the other way round in the strips between the loosened strips. Here, the air capacity is measurably lower. This suggests that for a good air supply, the soil should neither be loosened too much nor too little.

Straw needs nitrogen for rotting

For the straw to rot quickly in autumn, it is essential to reduce the C : N ratio. Straw as organic fertiliser doesn't play a major role today, because it is incorporated either intensively or multiple times. Those 7-10kg of nitrogen which are required by each tonne of dry straw for rotting are replenished by the soil. However, in minimal tillage systems straw incorporation is very shallow, i.e. the straw rots fast in this soil because of the very active soil life in the topsoil (C : N ratio approx. 15 : 1). In this case, the following crop will lack nitrogen after emergence. This lack delays the growth of oilseed rape in particular but also the growth of legume-free cover crop mixes and winter barley. This situation may last up to 8 weeks as trials found out. If sufficient nitrogen is available for straw rotting in autumn, the straw chops will have decomposed by up to 30% within the first 4 weeks.

Comparing straw chop sizes

In another trial, 3 different **chop lengths** were compared. Firstly, a high 30cm cut followed by a flail topper; secondly a high cut without subsequent topping; thirdly a regular stubble length of about 12-14cm. The crop yielded 61dt/ha* of straw and the moisture content was 20.5%. In these favourable conditions, the regular stubble length was chopped well enough in the high cut without shredding version where the target value "70 percent smaller than 4 cm" was nearly reached. As expected, the highest percentage of short straw chops was found in the high-cut variant that was followed by a shredding pass (fig. 2).

In each test version, the shredding was carried out by a different implement (fig. 3). The straw cover was measured after the first cultivation pass. It was found that the 4-bar cultivator incorporated the residues most effectively, that the short disc harrow achieved nearly good results and that the cultivator with goosefoot points working at a shallow angle did not incorporate the straw thoroughly. Surprisingly, the average thickness of the straw mat was nearly 10% higher in the "high cut with subsequent shredding" version than in the versions that simulated typical cultivation schemes. By splicing and chopping the stalks with the flail topper the surface area of the straw cover increased significantly. The second pass took place 21 days after the first cultivation pass. Here, however, only the variant "high cut with subsequent shredding" reduced the coverage notice-

FIG. 1: AIR CAPACITIES IN LOAMY SAND PLOTS AFTER DIFFERENT TILLAGE METHODS

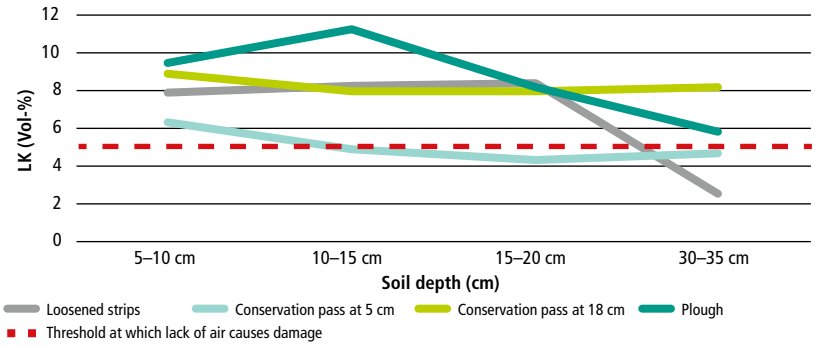


FIG. 2: HOW THE TILLAGE SYSTEM AFFECTS STRAW CHOPS

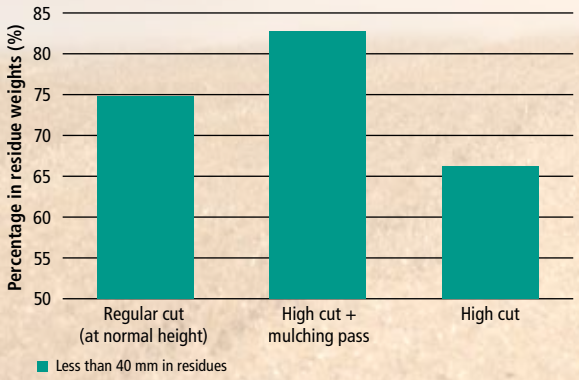
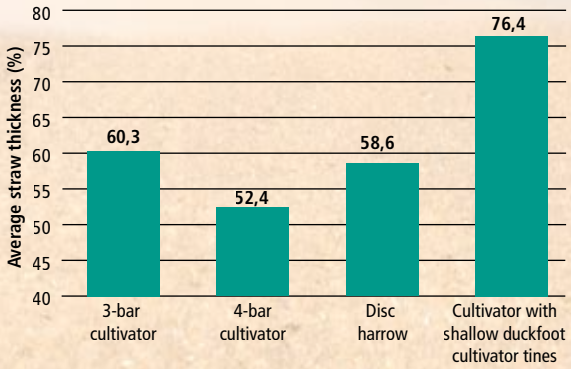


FIG. 3: STRAW COVER THICKNESS BY IMPLEMENT



ably. The lack of rainfall during this period not only retarded the rotting process but also made it more difficult to incorporate the light-weight chops.

The testers also verified the effectiveness of straw incorporation by size of straw chop. For this purpose, a small soil profile was created and the thickness of the cover was measured. The results were sobering: After the first tillage pass, the crop residues were incorporated hardly any deeper than 5cm. This applied to all test versions. Fig. 4 and 5 indicate the quantities of crop residues that were incorporated across a width of 2m and down to a depth of 15cm – either by a disc harrow or the 4-bar cultivator. The best quality of work was found in the "high cut with mulching pass" test version; and this applied to all types of implements. However, even well-shredded straw tended to build up in the 0-5cm layer. With the short disc harrow set to about 8cm, no straw could obviously be found in the 10-15cm depth zone. The 4-bar cultivator with a working depth of 12cm mixed in only negligible amounts of straw during the first cultivation pass. The situation hardly improved three weeks later after the second pass. The mineral nitrogen (N_{min}) value, an important parameter in straw rotting, was examined in 5cm steps. Straw that is incorporated at a shallow depth fixes nitrogen in the 0-5cm zone as it starts rotting. Consequently, the N_{min} value drops by 60%. It was found that neither the type of the implement nor the size of the straw chops had a measurable impact on this rate. If in wet conditions rotting starts immediately after the straw is incorporated, it can be assumed that the N_{min} value in the 0-5cm zone drops to an even lower level in the spliced chaff test version. The effect of this is that autumn crops that require nitrogen may show a less vigorous establishment.

Conclusion

Careful tillage is fundamental for a strong root growth in oilseed rape. Whenever oilseed rape was found to develop many lateral roots, it was also found that the air capacity was poor. Here, growers must review their tillage practices, the tillage depth or even the timing of cultivating. Another focus is on the straw management, i.e. the length of the straw chops, especially in rotations were oilseed rape follows quickly after wheat, for example. Modern and vigorous rape varieties and also extended vegetation periods suggest that growers can easily delay the sowing date for a week. Such a delay ensures better sowing conditions and reduces the pest pressure.

Photo 4: Straw incorporation by a disc harrow

Photo 5: Straw incorporation by a 4-bar cultivator

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