HOW HERBICIDE RESIDUES AFFECT THE PERFORMANCE OF OILSEED RAPE

Can a poor performance of oilseed rape also be attributed to residues of herbicides that were applied to a previous grain crop? This is a legitimate question, especially when looking at pictures as the one below.

The photo was taken on 31 Oct. 2011 and shows a field where the herbicide Attribut was applied to the previous wheat crop. The left side of the photo shows a regular variety of oilseed rape and the right side the variety Clearfield. Attribut is a grass herbicide that came under the spotlight also in other years, such as in 2003. The application instructions of this product say that the crop treated should not be followed by oil seed rape. Clearfield oilseed rape however is resistant to such herbicides as Attribut. Therefore, we can assume that the visibly great difference between the performance of the two varieties is attributed to residues of Attribut which was applied to the previous crop.

In order to assess the risk of chemical agents reproducing themselves, scientists are exploring the half-life of an agent. This is done by applying it to the soil and sampling this at specific intervals to measure the amount of agent that is still present in the soil. The results are expressed in half-lives, i.e., the time it takes for the agent to degrade 50%. The unit of measurement is DT50 (DT stands for Dissipation Time). The half-life of the agent Propoxycarbazone-sodium in Attribut is 40 days. This is a mean value that was determined by greenhouse studies at temperatures of 20 °C and in moist soil. However, scientists point out that the actual measurements varied greatly depending on soil and climate conditions and in fact ranged from 8 to 250 days.

Soil moisture is the primary parameter to affect the rate of degradation. Accordingly, damage to the following crop was found only in dry conditions. The next major parameter is the date of application. This was found in tests evaluated by the company DuPont as well as other tests. They assessed the impact of the agent Metsulfuron-methyl which was applied to grain in the spring. The next crop in the rotation was oil seed rape (see Table 1). Severe damage in the form of inhibited growth and bleaching was observed only in those fields where the substance had been applied at a late date. This suggests that a taller stand and the shielding this provides to the soil do not make up for a late application. The third parameter is the quality of the soil. Agents such as Propoxycarbazone-sodium are degraded by hydrolysis. This process is however significantly delayed in soils with high pH values, i.e., with low levels of free hydrogen (H+) ions. See Table 1 and the evaluation there. By comparison, in fields where pH values are less than 6.5, it was found that no relevant damage was caused by products containing Metsulfuron-methyl. In addition to the physical impact, there is also a biological impact. Moisture is another factor that is required for microbial degradation. If capillary activity is obstructed by structural damage in the soil, the degradation of the agent is impaired. Further factors promoting or inhibiting degradation are the type of soil, the tilth and humus contents. Among other things, humus serves as food for soil organisms that are involved in the degradation of agents and also absorbs these.

The picture shows a field, where the herbicid Attribut was used in the previous crop wheat. On the left side of the field was sown conventional oilseed rape and on the right side was sown Clearfield oilseed rape.

How to avoid damage due to ALS inhibitor residues

1. Choose alternative products for grass control

The products Axial 50, Traxos and Sword have no impact on the following crop. This risk is also very low in Lentipur 700, Broadway or Avoxa. These chemicals can be applied provided they are still effective. Avoxa is particularly suitable for controlling Trespen.

2. Schedule treatments as early as possible

Should the above-mentioned agents have lost their efficacy (usually on field foxtail), Atlantis Flex, Niantic or Atlantis OD (in drained fields) should be applied as early as possible. In warm lowland areas and good growing conditions the treatment can be carried out even as early as in January. The mild winters in the last few years have allowed grasses to grow without a pause. Yet the taller they grow, the harder will it be to control them effectively. Consequently, we are likely to see more treatments carried out as early as in autumn, which by the way gives enough time for the agent to degrade.

3. Treat bur-chervil in autumn

Like pansies and speedwell, bur-chervil can be easily controlled in autumn. Bur-chervil (which is also more resistant to ALS) can be treated with Chlortoluron (1250 g/ha) or Zypar in autumn, for example. In spring, however, ALS inhibitors are usually the only option for controlling bur-chervil. These treatments are often carried out late, because the infested patches are noticed only during applications of growth regulators or fungicides. If treatments are necessary in spring, you should preferably work with Refine Extra or Protacur, because the half-lives of these products are shorter than those of products based on Metsulfuron-methyl.

4. Optimise the soil structure and promote soil life

This is the last and single most important factor which however requires a long-term strategy. In the short term, the risk of damage can be greatly reduced by ploughing or by cultivation with an intensive mixing effect.

Factors that increase the risk of herbicide damage due to ALS inhibitors:

1.Drought
2. Application at a late date
3. High pH values
4. Poor soil structure / low humus levels

How big is the problem?

Severe crop damage was often found to be attributable to Attribut. Yet Attribut has only a small market share and oil seed rape doesn't usually follow a crop that was treated with the product. If these facts are related to the size of acreage that is treated with „Atlantis products" every year, it seems that these combinations of agents are less critical. There are plenty of examples that show the differences: treated boundaries, overlap zones, intentional and unintentional spraying windows. What about invisible damage? In the 2011-2013 period, Clearfield varieties were compared with conventional varieties at various locations, including in the federal state of North-Rhine Westphalia. Among the four Clearfield varieties compared were two varieties that had the latest genetics for a yield potential that at the time was at least on par with the best conventional hybrids. These, too, followed winter wheat that was treated with Atlantis WG, for example (400-500 g/ha). Our tests showed no relevant differences in terms of yields.

There was only one single parameter that was persistently found to account for yield differences in surveys. This was the number of oilseed rape crops within the rotation. Herbicide residues have not yet been found a significant factor to impact yields.

This said, in the autumns of 2018 and 2019 - i.e., after very dry vegetation periods - the autumn performance of oilseed rape was more often found to be affected by previous herbicide treatments. Although the extent of the damage was smaller than anticipated it became clear that there was a correlation. As extended periods of drought during the spring and summer months are likely to be the rule rather than an exception, it is certainly wise to review and adjust one's herbicide treatment measures to minimise the risk of damage to the following crop.

TAB. 1: METSULFURON-METHYL CONTAINING PRODUCTS APPLIED TO A CROP OF CEREALS AND THEIR IMPACT ON THE FOLLOWING WINTER OILSEED RAPE.

	Application date: March/April				Application date: May or later			
pH value of the soil	Number of tests carried out	Percentage of samples showing bleaching/ inhibited growth		Countries	Number of tests carried out	Percentage of samples showing bleaching/ inhibited growth		Countries
		20%	50%			20%	50%	
pH < 6,5	24	–	–	FR, DE, DK	10	–	–	FR, DE, DK
pH 6,5–7	13	–	–	FR, DE, DK, PL	5	40%	–	FR, SE
pH 7,1–7,9	19	5%	–	FR, DE, HU, UK	18	–	11%	FR, DE

Trials from 1984-2013, in France, Germany, Denmark, Poland, Hungary, Serbia and England. Source: DuPont, 2015

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