PROTECTING CEREAL CROPS

WHICH AGRONOMIC MEASURES can be taken to limit the harm caused by pests?

There are a few ways of indirectly controlling pests in cereal crops. Properly combined, they can limit the factors that encourage bioaggressor populations' development and significantly reduce the harm that these cause. However, this type of preventative control is a long-term strategy and is far from being a blanket solution for all pests.

The various pests that target cereal crops differ greatly in size, in living environment, in biological needs, as well as in population levels before they cause significant damage. Vertebrates, molluscs, insects and nematodes can be present in, on or under the plants, and cause damage at different stages of the crop's development.

A few measures, often pest specific or even growth stage specific, can be implemented. Their effect is rarely comprehensive. In some cases, the planned action to control a pest can even expose the crop to other biotic or abiotic stresses. The agronomic measures that have been identified as having an effect on particular pests in cereal crops are linked to the choice of rotation system, the use of appropriate techniques at the intercropping season, adjusted sowing dates, varietal choice and the implementation of specific cropping practices. Most of the time, it is mainly a case of avoiding conditions that encourage an infestation that, in turn, is likely to be very harmful.

« ***Barley yellow dwarf virus, which is transmitted by aphids, can be controlled by using one of the few barley varieties tolerant of the disease*** »

Situations to be avoided in the rotation

Stretching the rotation or introducing break crops helps to reduce cyst nematode populations in cereal crops. However, apart from this example, crop choice does not significantly reduce the population of a pest that is already present. Some of the crops in the rotation may turn out to be less sensitive to it, but this does not reduce the risk for future cereal crops.

Conversely, some crops may increase the risk. Those with prolonged soil cover and no cultivation, such as grassland, lucerne and seed crops provide feed sources and a stable environment that encourage various pests such as wireworms, corn ground beetles and small rodents to reproduce and ensure their survival.

Short cereal rotations and preceding cereal crops can also encourage the perennial presence of some pests (cereal cyst eelworm, gall midge, corn ground beetles, etc.) and must therefore be avoided. Lengthening the rotation by alternating winter and spring crops can be a solution, but this decision also

depends on the soil and the economic context. Finally, preceding crops other than cereals can also be the cause of subsequent infestations in cereal crops. It is the case with beet, which provides an ideal egg laying environment for wheat bulb fly, or of oilseed rape which is very much appreciated by slugs.

The intercropping season is key for pest control

Stubble cultivation just after harvest, residue management, repeated soil cultivation and destruction of volunteers from the preceding crop all help to reduce various pest numbers by destroying their habitat, their sources of feed or the pests themselves. They also reduce virus reservoir plants. Those cultural operations help to contain slug, wireworm, corn ground beetle and cyst nematode populations, and more indirectly, limit the presence of viruses transmitted by insects.

As for soil cultivation prior to sowing, ploughing provides valuable help against some pests, such as corn ground beetles, and small rodent burrows. However, it may also simply bury other pests (slugs and gall midge cocoons in diapause), therefore spreading out their aggression period and making them more difficult to control.

Generally, a green cover during the intercropping season can generate conditions favourable to pests. Also, some plant species such as grasses that act as virus reservoirs (oats, rye...) are not advisable. To control slugs, some species such as mustard and phacelia should be favoured as they are not palatable to slugs and therefore reduce their prolificity.

Late or early sowing?

Sowing earlier or later than normal aims to avoid the most sensitive growth stage of the crop coinciding with the periods of time most favourable to the presence of pests and their attacks. Late sowing generally helps protect the crop from aphids and leafhoppers, by avoiding periods that are favourable to the dissemination of those insects.

However, when tillering is delayed, the crop can be at risk of greater slug damage, which wouldn't have been as severe if it had occurred at the tillering stage. Moving the sowing date is not very effective either in controlling aphids carrying the barley yellow dwarf virus (BYDV) if weather conditions keep encouraging their presence; even with small numbers to start with, dissemination from one field to another can lead to significant damage, as was the case in the autumn of 2015 in France.

On the other hand, if on the contrary weather conditions grow much colder, late sowing may have an adverse impact on crop establishment. Generally, this practice has an impact on the cropping operations, as well as on yield potential. Regardless of the date, some precautions are recommended at sowing time: no seed should be left on the soil surface (birds, slugs, etc.), and slug habitats (hollows) should be destroyed by rolling straight after sowing if applicable.

Control through genetics is effective but still patchy

At the moment, using genetics to protect cereals from pests is not a widespread practice. It focusses primarily on orange wheat blossom midge (OWBM) control, by integrating the Sm1 resistance gene into the bread wheat genome. Around thirty varieties are currently available. Given the partial effectiveness of insecticides on plants to control OWBM, which requires regular observation with a narrow treatment window, using resistant varieties is by far the most effective solution. This resistance being very specific, bread wheat varieties are not protected against yellow wheat blossom midges (YWBM).

A second example of genetic solution relates to the barley yellow dwarf virus (BYDV) in barley. The Standing Committee on Plant Breeding (CTPS) has registered five BYDV tolerant varieties of winter barley. This tolerance is based on the presence of the Ryd2 gene, which does not protect against aphids, but ensures a tolerance of the disease with low levels of symptoms when a plant is infected with the virus. Although tolerance is not total, it has nevertheless conferred sufficient protection to date; the varieties that are available do not cover all markets (for example, there is no BYDV tolerant variety for wheat). Plant breeders are currently focussing on this criterion and actively looking at other sources of resistance/tolerance. Research work is also intensifying as part of the collaborative "JNOrge" project supported by the FSOV fund.

Differences in the level of varietal sensitivity to certain pests are often reported, without the processes at work being properly identified nor the repeatability of those differences being ascertained. However, work is focussing on developing certain characteristics, such as strong tillering so that the plants better resist attacks from wheat bulb fly.

Odd crop operations during the season may hinder some pests' activity. If the soil is cloddy after sowing, rolling may temporarily reduce slug activity.

For vertebrate pests, bird scarers or systems to entice vole predators to establish themselves are often mentioned but their effectiveness has never been measured.

Although the effectiveness of biocontrol agents has rarely been tested with regards to autumn pests, their presence must be safeguarded in the spring to avoid ear aphids multiplying exponentially. This explains why the use of insecticide is only justified if a crop has reached its sensitivity threshold and those pest populations are heavily developed.

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