Should strobilurins still be used in wheat? Danish and foreign experience

Since strobilurin resistance has developed in several diseases in wheat the benefit from using this group of fungicides has become marginal.

Danish experience

Since strobilurins were introduced in 1998 they have been known for their good control of several diseases in wheat, just as it has been known that they could improve the net yield by 2-4 hkg/ha compared with treatments with triazoles, such as Opus and Folicur.

Shortly after strobilurins were introduced, resistance was unfortunately demonstrated in wheat powdery mildew (*Blumeria graminis*); later development of resistance followed in wheat leaf blotch (*Septoria tritici*), and lately resistance has also been seen in tan spot (*Drechslera tritici repentis*). This means that today’s application profile for strobilurins is quite limited compared with 1998, when they were introduced. Especially the development in resistance to septoria has had great importance for the fate of these products. In the last comprehensive count in summer samples in 2004 there was 81% resistance in the Septoria tritici population. This high level of resistance has the effect that one can no longer expect to achieve a usable septoria control with strobilurins. Table 1 shows in brief the approvals of important fungicides in recent years, including recommended mixture ratios for septoria control.

The key question in the last two years’ trial work has therefore been to find out whether it is still economically feasible to recommend strobilurins being mixed with triazoles (especially Opus) despite the high level of resistance to septoria.

Overall, the Danish results from both the Danish National Field Trials and the Danish Institute of Agricultural Sciences showed a very limited advantage in going on using strobilurins after septoria resistance has become widespread (Table 2). Measured in both disease control and margin over fungicide cost the addition of a low dose of strobilurin (0.1-0.2 l/ha) has resulted in a marginal improvement. The improvement has been on a level with the use of an increased dose of epoxiconazole. Greening effect from the use of strobilurins has only been observed to a limited extent.

Experience from abroad

Today, there is a high level of strobilurin resistance in septoria in most of Europe. However, there are still areas in southern Germany, southern France, Poland and the Baltic States, where there are rather low levels of resistance.

Many trials have been carried out in European countries (Germany, the United Kingdom, Ireland, Belgium and France), where it has been studied whether there is a basis for continuing with a recommendation, where strobilurin can be added

Table 1. Historical approval events for strobilurins, including recommended mixture ratios.

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<th>Year</th>
<th>Recommendations of strobilurins for control of septoria</th>
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<tr>
<td>1998-1999</td>
<td>Amistar and Mentor are approved; Strobilurins are recommended alone or mixed with Folicur (approved 1997).</td>
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<td>2000-2003</td>
<td>Strobilurin + triazol are recommended in the ratio of 1:1. When Comet comes on the market in 2002, this agent is preferred as it has a better effect than Amistar.</td>
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<td>2004</td>
<td>Septoria resistance is found in many localities. Strobilurin + triazol is recommended in a ratio of 1:2 or 1:3. Comet still seems to be somewhat stronger than Amistar. Example of recommendation: 0.15 l Comet + 0.30 l Opus.</td>
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<td>2005</td>
<td>Triazoles are recommended alone or with addition of a small dose of strobilurin. Example of recommendation: 0.4 l Opus + 0.1 l Comet/0.11 Amistar.</td>
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for control of septoria. From many trials a small advantage is seen in adding strobilurin to Opus. However, variation is large, and it is not immediately possible to predict where an extra yield for the strobilurins can be expected. On average, the extra yield is approx. 3 hkg/ha. An extra yield, which, however, only just can pay for the cost of the extra strobilurin contribution. Generally, there has only been a limited greening effect in 2005, among other things due to a very fast ripening. An addition of a half to a full dose of strobilurin was typically tested in the foreign trials; this is considered to be unrealistically high doses under Danish conditions.

Generally, it is estimated that it is possible to achieve about 30% control of septoria with pure strobilurins in localities where there is septoria resistance. This will generally be insufficient in practice. In some trials a slight advantage from Comet has been observed in comparison with the other strobilurins, but the tendency is not always clear. There is common agreement that the triazoles (especially Opus and Proline) will be the main components in the control of septoria in the future. Moreover, many countries recommend using chlorothalonil (Daconil) for the first septoria treatments.

For *Septoria tritici* it has been found that some strobilurin-resistant isolates still have some sensitivity to strobilurin. These isolates possess a so-called intermediary resistance and were found in 2004 in about 10-15% of the strobilurin-resistant isolates (Source: Syngenta). The relatively small share means that it is of relatively little importance under practical conditions. It is found that a higher dose is necessary to give a satisfactory control of the intermediary isolates, which also has been seen under Danish semi-field conditions. This means that it is economically uninteresting in comparison with other solutions.

Several of our neighbouring countries will still recommend strobilurins for the coming season but mainly for late treatments and in situations where positive side effects are expected on e.g. Fusarium/Michodochium nivale, rust and DTR.

### DTR strobilurin resistance

Since 2004 isolates have been found that are resistant to tan spot. This disease is generally considered to be a problem only in Sweden, parts of Germany and France and in Denmark. For a number of years Sweden has experienced a reduced effect of strobilurins in several trials, and in Denmark we have seen problems in a number of trials since 2003. Today, strobilurin resistance in tan spot has been observed in Germany, Sweden and Denmark.

In tan spot two types of strobilurin resistance have been found. First F129 and later G143. Both mechanisms have been found under Danish conditions. If an isolate only has F129, the strobilurins will still give a relatively good effect of the applied doses, whereas this is not the case when G143 is present. It is expected that G143 will increase in the future compared with F129, which will increase the risk of a low effect from the strobilurins on this disease.

The development of strobilurin resistance means that the recommendations for control of tan spot have been changed from recommendations containing both strobilurin and triazol (Tilt) to solutions containing only triazols.

A large number of DTR isolates from different localities are at present being studied at the Danish Institute of Agricultural Sciences at Flakkebjerg to find how widespread the DTR strobilurin resistance is.