



Summary

Growing cultivars with good resistance to major diseases in winter wheat is a major factor for reducing disease problems in the crop. The benefits of growing resistant cultivars are significant and are very important in reducing the dependence on fungicides in an integrated pest management (IPM) strategy. In a specific season the number of fungicide treatments can be reduced by one or two and doses applied can be reduced by between 25 and 50% depending on the season and level of resistance in the cultivar.

Control of disease using resistant cultivars can provide savings in the range of €20/ha compared to the cost of controlling diseases in susceptible cultivars. Farmers also gain more flexibility with respect to timing and choice of dose if they choose the most resistant cultivars. Resistant cultivars will, however, not solve all problems, as the stability of resistance genes changes gradually over time.

There is major scope for better exploitation of genetic resources, which should include a constant focus from breeders and scientists in search of new sources of resistance as well as annual testing of all major cultivars to provide updates on any changes in virulence.

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About ENDURE

ENDURE is the European Network for the Durable Exploitation of Crop Protection Strategies. ENDURE is a Network of Excellence (NoE) with two key objectives: restructuring European research and development on the use of plant protection products, and establishing ENDURE as a world leader in the development and implementation of sustainable pest control strategies through:

- > Building a lasting crop protection research community
- > Providing end-users with a broader range of short-term solutions
- > Developing a holistic approach to sustainable pest management
- > Taking stock of and informing plant protection policy changes.

Eighteen organisations in 10 European countries are committed to ENDURE for four years (2007-2010), with financial support from the European Commission's Sixth Framework Programme, priority 5: Food Quality and Security.

Website and ENDURE Information Centre

www.endure-network.eu

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Using Cultivar Resistance to Reduce Fungicide Input in Wheat

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Differences in appearances in a susceptible and a resistant cultivar in July. The main reason for senescence in the leaf area is an attack of septoria leaf blotch
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Cultivar resistance against major diseases offers the greatest potential for reducing dependence on fungicides in integrated control strategies

Yield losses from specific diseases in winter wheat are significant in most seasons in the major wheat growing countries of Europe. In terms of yield loss and grain quality, diseases such as septoria leaf blotch, brown rust, take-all and fusarium head blight are considered the most important diseases in the main wheat growing countries, with yield losses between five and 25 dt/ha common in many regions. Yellow rust, powdery mildew, tan spot and eyespot are also important diseases, but their distribution is much more regional.

Resistance of widely grown varieties

The use of cultivars with effective resistance genes is well known as an important measure to reduce the risk of disease development and yield losses. Breeders aim to include effective resistance genes to major diseases in new cultivars. This includes using either specific resistance genes, unspecific resistance or both.

The genetic resources used across Europe vary to a great extent as very few cultivars are grown in more than one country. All countries have an extensive cultivar testing system but the way of ranking resistance characteristics is quite different across countries. Data from cultivar testing has shown that

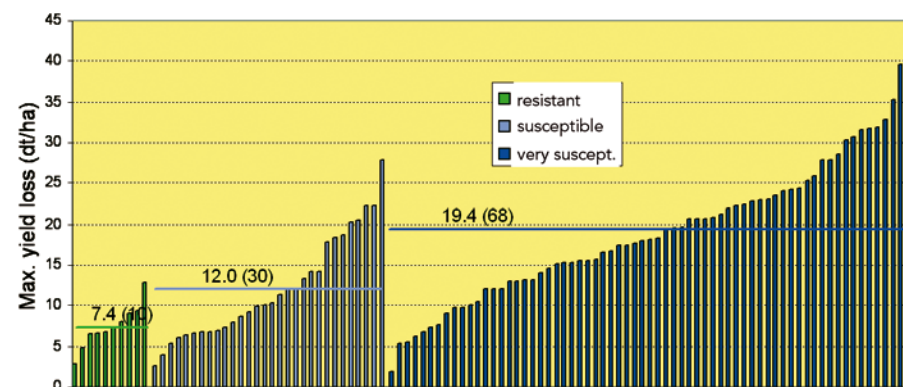
under high disease pressure even the most resistant cultivars often give profitable yield responses from fungicide treatment. This indicates that the resistance genes, although they help a lot, rarely cover all potential diseases that can attack the crop.

Particularly in relation to occurrences of yellow and brown rust, it is well known that resistant cultivars can completely eliminate the risk from these diseases. This is not seen to the same extent with diseases such as powdery mildew, septoria leaf blotch, tan spot and fusarium head blight, where often only moderate levels of resistance are seen.

Benefits of resistant cultivars

Use of cultivars resistant to foliar diseases can lead to a large reduction in yield loss between fungicide treated and untreated plots, as illustrated with French data (see graph above right). It can also be observed that the difference in fungicide response can vary greatly between trials, essentially due to differences in disease pressure between locations.

On average, improved disease resistance in cultivars gives a reduction in yield loss due to disease. Trial data has shown that the use of a resistant cultivar allowed for an average decrease of optimum fungicide expense of €20/ha.



Distribution of yield loss in 108 trials in 2005 for three classes of resistance to foliar diseases. Horizontal bars represent mean values. The first number above the bar is the mean value and the second (in brackets) is the number of trials used to establish the mean

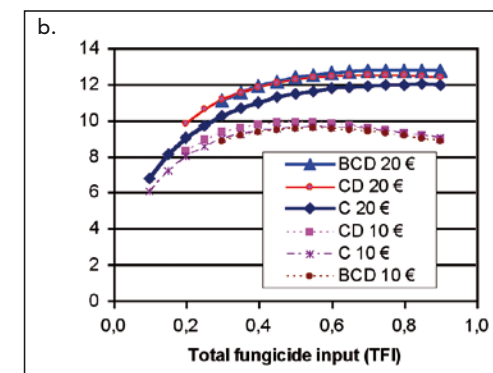
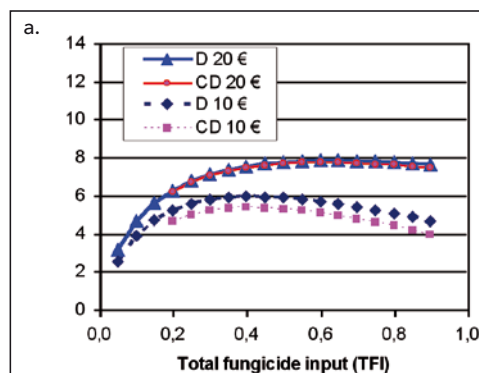
Resistant cultivars and reduced fungicide rates

Analysis of historical trial data from Denmark shows much flexibility when choosing fungicide input, as the dose response curves are quite flat. The grain price is known to fluctuate between seasons which has a significant effect on the optimal fungicide strategies and input.

Susceptible wheat cultivars: In the case of a higher wheat price (€20 per dt), a three-spray strategy (BCD strategy) becomes slightly more efficient than the two-spray strategy - applied at CD timing (see graph), and the most efficient total fungicide input increased by 50% from 0.5 total fungicide input (TFI) to 0.75 TFI.

Resistant wheat cultivars: In the case of a higher wheat price (€20 per dt) a one-spray strategy (D strategy) was still the most efficient in the most resistant wheat cultivars (see graph), but here too the most efficient fungicide dose increased by 50%.

In UK trials similar results have been obtained. Here, the optimal input in susceptible cultivars was about double the amount compared to using a resistant cultivar. Resistant varieties also provide greater flexibility in timing and dose and give less loss if, for various management reasons such as rainy periods, timing cannot be optimal.



Calculated net yield gain (dt/ha) in winter wheat in resistant (a) and susceptible cultivars (b) for selected strategies using two prices for grain. Based on data from Denmark 1999-2003. The legends are ranked according to the most beneficial solution. A: GS 25-31, B: GS 32-36, C: GS 37-50, D: GS 51-64 and E: GS 65