Fungicide Resistance Management in Oilseed Rape

Fungicides are used for disease control and, in some cases, for plant growth regulation and other physiological effects. Stem canker, light leaf spot and sclerotinia are the most serious diseases of oilseed rape against which fungicides are used. Disease development is very variable from year to year and spray timing is critical to ensure effective disease control. Fungal pathogens of oilseed rape are showing reduced sensitivity to some fungicides and there is concern about declines in efficacy. Robust strategies to prevent further deterioration are vital if we are to retain effective fungicides in the future.

General strategy for managing fungicide resistance

An integrated approach to disease and crop management and, hence, a strategy for fungicide resistance management should be followed.

Use disease resistant cultivars. Where possible, varieties should be selected with good resistance ratings to the diseases of most concern on the farm. Reduced fungicide inputs may be possible on such varieties and should reflect overall disease risk.

Target fungicides on crops where there is risk of yield loss. Seasonal variation in risk can be large, so use local guidance. Use disease forecasts, crop monitoring information and thresholds, where available.

Ensure fungicide applications are well-timed and the appropriate dose is used.

Avoid repeated use of the same product or fungicide having the same mode of action. It is important to follow any statutory conditions of approval, which may include a maximum number of product applications per crop or a maximum total for the active ingredient.

Crop residues are a source of inoculum for phoma leaf spot and stem canker (*Leptosphaeria* spp), light leaf spot (*Pyrenopeziza brassicae*) and dark leaf-spot (*Alternaria* spp). Direct drilled crops may, therefore, be at greater risk than crops drilled after deep ploughing. Burying crop residues can help to decrease the production of air- or splash-borne spores. Avoid planting new crops adjacent to the previous year's stubble. Isolate new crops by 200 to 500m, if possible.

Sow by late August so that plants are well-grown prior to the onset of phoma leaf spot. The disease is less damaging and easier to manage on plants with large leaves than on small plants. Early drilling, however, can increase the risk of light leaf spot, therefore all crops should be walked regularly and monitored carefully.

Oilseed rape rotations are often shorter than ideal. The risk of soil-borne diseases such as clubroot (*Plasmodiophora brassicae*) and sclerotinia (*Sclerotinia sclerotiorum*) will be reduced by extending rotations to at least one in four and preferably longer. Trash-borne disease risk (light leaf spot and phoma) will also be reduced in extended rotations.

Biological control with *Coniothyrium minitans* can be considered as a biological treatment as part of an integrated pest management(IPM) strategy. It works by colonising and de-activating the soil-borne sclerotia. Application may be useful after severe attacks of sclerotinia to reduce the risk of yield loss in future crops.

Fungicide resistance in oilseed rape

Phoma leaf spot & stem canker (*Leptosphaeria maculans* and *L. biglobosa*)

- **Timing of fungicide application is critical**. Use fungicides in response to disease forecasts, crop monitoring and thresholds. Control of stem canker is best achieved by controlling the asexual phase of the pathogen, i.e. phoma leaf spot, in the autumn. This can be achieved by applying fungicides in response to thresholds (10 to 20% plants affected and further treatment when re-infection observed 4 to 10 weeks later) to decrease the likelihood of the disease spreading to the stems. Varieties with good resistance may only require a single fungicide application at threshold to achieve control.
- **DMI, SDHI and strobilurin fungicides are approved as treatments.** DMIs are a component of many currently available products. Products containing mixtures of fungicides with different modes of action, such as SDHIs or strobilurins, allow for a range of actives to be used in the course of a spray programme with a lower risk of selecting for resistance for any one component. Follow the latest AHDB information on selecting the most effective products and doses.
- **Seed treatments** can help to reduce damping off.

Light leaf spot (*Pyrenopeziza brassicae*)

- **Use fungicides protectantly in response to disease risk.** Consider information from disease forecasts and crop monitoring. The risk of disease can also be affected by the disease resistance rating of the variety. Fungicides are most effective when applied before significant levels of disease are present and so application in late autumn and in the following spring are common. Prior to 2014, light leaf spot control was reliant on DMI fungicides and some isolates with decreased sensitivity have been noted/or reported. SDHI plus strobilurin mixture products are now available which allow for the alternation of products within the fungicide programme.
- **Follow latest AHDB information when selecting fungicides** as this provides guidance on the most effective products and doses. Alternate effective products and consider using different modes of action to DMIs when targeting other diseases, such as sclerotinia at mid-flowering.
- **Avoid home-saving seed** from heavily infected crops as there is some evidence of transfer via surface contamination of seed.

Stem rot (*Sclerotinia sclerotiorum*)

- **Only use fungicides when necessary.** The risk of yield loss is low in crops with no history of the disease, so fungicide treatment may not always be necessary. Disease risk is increased where there is a previous history of the disease, by short rotations and by wet weather during petal fall. Make use of disease forecasting systems that monitor for risk factors including spore release, prevailing climate and crop growth stage to help guide decisions. Manage disease risk in the context of your crop rotations and extend rotations of susceptible crops as part of an IPM approach. Consider the use of a biological control agent in fields, where disease is noted.
- **Do not rely on one fungicide group.** A range of fungicides with different modes of action are available, such as DMIs, strobulurins, SDHIs and MBCs. Try to use different modes of action to those used earlier in foliar disease control programmes.
- **SDHI and MBC resistance has been detected in this pathogen in Europe.** Despite monitoring, no resistance to any fungicide mode of action has been found in the UK.

Refer to the product label for recommendations on the use of solo modes of action, as some may require application in tank mix with a product from another mode of action group e.g. SDHIs.

Dark leaf and pod spot (*Alternaria brassicae and A. brassicicola*)

- **Seed treatments** help reduce disease incidence.
- **Do not rely on one fungicide group.** There is now a range of fungicides with different modes of action available, including examples from the DMIs, dicarboximides and strobilurins. Sprays applied to target sclerotinia containing these actives will also have efficacy against dark leaf and pod spot.
- **Only treat for this disease if the severity warrants it.** Reducing the use of marginal sprays and, hence, the overall number of sprays to the crop is important in reducing selection pressure.

Grey mould (*Botrytis cinerea*)

- **Avoid reliance on a single fungicide group.** Resistance is known to exist to strobilurin and dicarboximide fungicides. Mutations conferring reduced sensitivity to SDHI in Botrytis are reported in Europe.

Downy mildew (*Hyaloperonospora parasitica)*

- **Fungicides are rarely needed** and no seed treatments are available.

Table 1. Summary of fungicide resistance issues in oilseed rape pathogens

Pathogen	Active ingredient	Sensitivity shifts	Field resistance
Stem Canker *Leptosphaeria maculans*	SDHI	x	x
	QoI	x	x
	MBC	x	x
	DMI	x	x
Leptosphaeria biglobosa	SDHI	x	x
	QoI	x	x
	MBC[1]	x	x
	DMI	x[1]	x
Light leaf spot *Pyrenopeziza brassicae*	SDHI	x	x
	QoI	x	x
	MBC	✓	✓
	DMI	✓	✓
Sclerotinia stem rot *Sclerotinia sclerotiorum*	MBC	✓	✓ (France)
	SDHI	✓	✓ (France)
	QoI	x	x
	dicarboximide	x	x
Dark leaf and pod spot *Alternaria spp.*	dicarboximide	?	?
Grey mould *Botrytis cinerea*	MBC	✓	?
	dicarboximide	✓	?
Downy mildew *Hyaloperonospora parasitica*		?	?

[1] Laboratory tests indicate that *L. biglobosa* may be slightly less sensitive to some DMIs than *L. maculans*.

Fungicide groups available for use on oilseed rape

Fungicide Groups	FRAC Mode of Action Code	Chemical Families	Common name of active substance	Examples of products with active substances [1]	
				Alone	In mixtures
DMI fungicides (DeMethylation Inhibitors) (SBI: Class I)	3	Imidazole	prochloraz	Poraz	Bumper P
		Triazole	cyproconazole	Centaur	Priori Xtra
			difenoconazole	Plover	Toprex
			metconazole	Caramba	Tectura
			propiconazole	Bumper 250 EC	Bumper P
			prothioconazole	Proline	Prosaro
			tebuconazole	Folicur	Agate
SDHI fungicides	7	Pyridine carboxamide	boscalid	Filan	Tectura Pictor
			penthiopyrad	-	Refinzar
			fluopyram	-	Propulse
			isopyrazam	-	Symetra
			bixafen	-	Skyway 285 Xpro
QoI fungicides (Quinone outside Inhibitors)	11	Strobilurin	picoxystrobin	Galileo	Refinzar
			dimoxystrobin	-	Pictor
			azoxystrobin	Amistar	Priori Xtra
Dicarboximides	2	Dicarboximide	iprodione	Rovral WG	Compass
MBC fungicides (Methyl Benzimidazole Carbamates)	1	Thiophanate	thiophanate-methyl	Topsin WG	Compass
					-
Dithiocarbamates and relatives	M3	Dithiocarbamate	thiram	Thiraflo	Hy-Pro Duet

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For a full list of the FRAG-UK committee members, see the FRAG-UK website cereals.ahdb.org.uk/frag

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