



Close up of Fusarium Patch. (Courtesy of Vitax Ltd)

Nature's cure



Graham Paul offers some useful fungicide advice, which can also go towards building your BASIS Points

If you are using fungicides or advising others on their use to control turf disease, you will understand the need to keep abreast of this rapidly changing market place.

Advances in chemistry and technology may cause us to change our thinking on how to choose fungicides to combat the ever present threat of disease on sports and amenity turf. The simple choice of contact fungicides in the winter and systemic products in periods of strong growth now has to be tempered by the fact that the modern fungicides, brought in to replace those withdrawn on environmental or toxicological grounds, do not always behave in the manner we are accustomed. This article reviews the introduction of a new group of fungicides to the turf market and how they are best used for maximum effect.

In 1977 a group of German scientists discovered two anti-fungal antibiotics which they named 'strobilurin A' and 'strobilurin B' because they were isolated from the pine cone fungus *Strobilurus tenacellus*. This organism produces these natural fungicides to restrict other species of fungi that are competing for its main food source. As a result of this research we now have a whole new family of fungicides based on these naturally occurring products.

Strobilurins were found to be very effective against a wide range of species, from all of the four families of fungi but were easily broken down by UV light. Strong sunlight is not an issue to the pine cone fungus living on the heavily shaded forest floor but out in the open it's a different matter, so UV stable synthetic strobilurins were produced to get round the problem.

Today we have three strobilurin molecules registered for use on

Further advice on the use of QoI fungicides can be found on the FRAC website (See References below)

References:

1) Fungicides Resistance Action Committee – QoI Action Group <http://www.frac.info/frac/index.htm>

2) Fungicide resistance in crop pathogens: How can it be managed?

FRAC Monograph No. 1 (second, revised edition) Keith J Brent and Derek W Hollomon

3) Strobilurin fungicides: Nature's Cleanup Crew – Liskey E. Grounds Maintenance 2002

4) QoI (Strobilurin) Fungicides: Benefits and Risks – Vincelli P. Univ. Kentucky <http://www.apsnet.org/education/advancedplantpath/topics/strobilurin/top.htm>

turf in the UK. The first of these was azoxystrobin, launched under the brand name 'Heritage' in 1997 followed soon after by 'Scorpio' (trifloxystrobin) and 'Insignia' (pyraclostrobin). Since the initial introductions there have been several 'me too' products formulated from straight strobilurins and two mixtures with other fungicides; 'Headway' (azoxystrobin and propiconazole) and 'Dedicate' (trifloxystrobin and tebuconazole)

All members of the strobilurin family have the same mode of action. They interfere with energy production in the fungal cells, bringing all activity to a halt – like tripping out a circuit breaker! To be more specific, they all have a 'single site' mode of

system enabling it to be distributed through the plant. Such movement is sometimes referred to as 'acropetal systemic activity' to differentiate it from 'true' systemic action, which involves both upward and downward distribution.

Trifloxystrobin ('Scorpio') and pyraclostrobin ('Mascot Eland') are not systemic or contact fungicides but they are strongly lipophilic and become firmly embedded in the waxy cuticle cells of the leaf surface. This makes them very rain-fast and during periods of slow growth they will persist for longer than the upwardly mobile 'Heritage'.

Bayer's product 'Scorpio' differs from the others in that it has the ability to move a short distance in

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Graham Paul**

action, targeting energy conversion in the cell – a process which is known to biochemists as 'mitochondrial respiration'. The strobilurins are classified under the group name QoI (which stands for 'Quinone outer Inhibitor' the specific binding site where they disrupt the cellular energy process). Without energy conversion the fungus cannot grow or reproduce and death follows.

However, despite the common mode of action of these QoI fungicides, the three active ingredients used in turf have fundamental differences in the way they move within the plant. All demonstrate 'trans-laminar' movement from one leaf surface to the other but azoxystrobin ('Heritage') also moves upwards in the plant's xylem

the vapour phase from one leaf to another or onto adjacent plants – so achieving a degree of re-distribution after spraying. Bayer describe the movement of their product as 'mesostemic' – reflecting the fact that it does not fit in with any existing terminology!

QoI fungicides are very effective at killing germinating spores, which makes them ideal for use as preventative treatments or in the very early stages of disease. However, they cannot be relied upon to work curatively on most diseases – especially those products that bind to the waxy cuticle: 'Scorpio', 'Insignia' and 'Mascot Eland'. Trans-laminar movement carries the active ingredient through the leaf tissues and out onto the other side where

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ABOVE: Turf disease control after an early year's start in West Sussex.

Both images on this page were featured in an article by Dr Terry Mabbett, entitled, "Focus on Fungicide," in *GI*, June 2009.

it re-binds with the cuticle wax. In the initial stages of disease, the germinating spore is located on the outside surface of the leaf and is easily controlled. Once the fungal hyphae penetrate the inside of the leaf the level of chemical present is often too low to halt the growth of the fungal mycelium. Therefore, timing is critical to the successful use of these QoI products.

A disadvantage of 'single-site' mode of action is that it offers a much greater potential for resistant strains to develop than is the case with fungicides having a 'multi-site' mode of action. Whilst I do not want to cause unnecessary concern over the potential for fungicide resistance in UK turf, it is something we all need to be aware of when selecting a fungicide strategy. Acquired resistance is an ever present threat that needs careful management to prevent the loss of valuable chemical weapons in the fight against disease. The turf market in the USA is much larger than ours in the UK and the QoI products have been used there more extensively and over a much longer period.

A study by the Fungicide Resistance Action Committee (FRAC) has revealed isolated cases of resistance to turf-grass diseases in the USA – notably; Anthracnose, Gray Leaf Spot and Pythium Blight – the latter two being of no importance to UK turf. However, the same group also reports isolated cases of resistance to *Microdochium nivale* in wheat grown in Europe. This same fungus is the cause of the UK's most important turf disease formerly known as Fusarium Patch.

Where a group of fungicides has the same 'single-site' mode of action, resistant strains of fungi will demonstrate cross resistance to all members in that chemical family. Consequently, rotation of fungicides and tank-mixes should

involve products from different chemical groups.

Many scientists believe the theory of evolution dictates that fungi will develop a way around any chemical agent in time. The strategy must therefore be to delay this for as long as possible by sensible use of these valuable materials.

In the past, cases of resistance have been attributed to over-use, under-dosing or incorrect application. When fungicide resistance develops, it is often the most popular, most effective material that becomes worthless almost overnight. Fortunately we now have watchdog groups like FRAC who routinely follow up and monitor suspected cases of acquired resistance and more importantly advise manufacturers and users on the best way to minimise resistance risk.

The following guidelines for use of QoI fungicides may help to prolong their usefulness:-

- They should be treated as preventative fungicides and applied before or at the earliest moment after the onset of visible symptoms.
- Fungicide programs must deliver effective disease management. Apply QoI fungicide based products at effective rates and intervals according to manufacturers' recommendations. Effective disease management is a critical component to delay the build-up of resistant pathogen populations.
- The number of applications per year must be restricted to the statutory requirement – whether used solo or in mixtures.
- Because all of the QoI fungicides have the same mode of action they will exhibit cross resistance to other members of the same group. Rotation of fungicides must therefore be outside the QoI family with substances having different mode of action.

So you can either direct people to the homepage: www.sherriff-amenity.com or direct to the article: www.sherriff-amenity.com/technical.asp?newsid=18.

SELF ASSESSMENT

Use the questions below to check your understanding of this topic. Readers can claim two BASIS points if the questions are answered correctly, by filling in the form online at www.sherriff-amenity.com

Circle the correct answer(s)

1) Which of the following active ingredients are registered for use on managed amenity turf in the UK? More than one may apply.

- a) pyraclostrobin
- b) fluoxastrobin
- c) azoxystrobin
- d) kresoxim methyl

2) What do the initials FRAC stand for?

- a) Friends Reunited Against Chemicals
- b) Fungicide Research into Agricultural Chemicals
- c) Fungicide Resistance Action Committee
- d) Federation of Royal Agricultural Colleges

3) Which UK turf diseases have produced strains resistant to QoI products in the USA?

- a) Fusarium Patch
- b) Anthracnose
- c) Gray Leaf Spot
- d) Take-all Patch

4 In general, how would you classify QoI fungicides in terms of their uptake activity?

- a) Contact acting
- b) True Systemic
- c) Trans-laminar
- d) Root absorbed

5) In which year were the strobilurin fungicides first discovered?

- a) 1979
- b) 1997
- c) 1977
- d) 1967

6) If a fungicide has a 'single-site' mode of action, will it:

- a) be unlikely to encourage resistant strains of the disease.
- b) work better in warm climates
- c) be more prone to develop resistance than those with 'multi-site' mode of action.
- d) be cheaper to produce