

## Fungicide Mode of Action & Activity Groupings

In order to get the most out of the products that are available, it is important to be aware of the specific characteristics of the products being applied including the mode of action and activity groupings.

When the turf manager is aware of the nature of the products they are using, this knowledge can be applied to make the correct decisions regarding the positioning of product within the plant for curative treatments, and the combination of products to be using in a preventative program.

### Mode of Action

Fungicide mode of action refers to the ability/inability of the active constituent to enter the plant and the nature in which it does so. Most products fall under three main modes of action, these are:

#### Contact

Contact fungicides do not enter the plant at all, and have activity only on the external fungal structures that they have physical contact with after application. The length at which these products are effective is governed by their ability to remain on the plant surface. The fungicides are most suited for preventative/ protectant applications, as they are unable to remove fungal structures within internal parts of the plant.

Actives such as mancozeb and clorothalonil have been used for many years and are regarded as important components of a fungicide program. This is because they have multiple modes of action and are essential for reducing the risk of fungal resistance. To ensure the effectiveness of contact products, technology is sometimes included in the formulation to prolong residual activity on the plant body.

#### Systemic

These fungicides are applied to the plant surface and move through the wax cuticle into underlying tissue. They do this by moving (often through a membrane) from an area of high concentration of active to areas of lower concentration, to reach equilibrium in both areas. A systemic product will travel through the vascular system moving to other areas within plant tissue.

Many actives make their way to the xylem of the plant, where they can move upwards (acropetally). These are among the most common systemic fungicides available, and often require irrigation following application to position the product in the root system.

Some actives are truly systemic and so can move through upwards through xylem and downwards through phloem; this is known as basipetal movement. The result of this is that the whole plant becomes protected from root tips to leaf tips. These truly systemic products are few and far between, with only one active (fosetyl AI) being commonly used in turfgrass. This unique method of movement within the plant often results in an extremely effective method of plant protection, in the case of fosetyl AI, against *Pythium* spp. This allows flexibility in application offering the turf manager option of whether or not they irrigate afterwards.

#### Locally Systemic (Translaminar)

Most active remains around the surface of the plant and does not usually travel very far within the tissue, hence the term locally systemic. However some active will diffuse through the wax cuticle and epidermis, entering the mesophyll underneath, this is known as translaminar movement.



These products are often very useful as curative fungicides as they control fungal growth on the surface of the plant tissue, as well as having activity on fungal structures inside the plant. Ipdodione is a perfect example of this mode of action, and due to the nature of the product it can be very effective against fungi such as *Rhizoctonia salani* (Brown Patch).

## Activity Groupings

Understanding the active constituents' activity on the target pathogen puts the user in a position to be able to manage pathogen resistance. It is always important to read product labels prior to use, as they will generally offer a guideline for usage patterns to help avoid resistance building. Resistance occurs when products with the same (or similar) activity groupings have been applied to a target organism over a period of time.

To prevent resistance from occurring products of different activity groupings must be rotated. This ensures that any genetic trait that has allowed target organisms to survive the previous application will now be controlled with the application of a different product.

In the Croplife Resistance Management Strategy it is recommended that no more than two consecutive sprays of a fungicides from the same activity group should be applied (other than Group 14, 28, M2, M3, M4 or M5), unless mixed with a protectant fungicide from Group 14, 28, M2, M3, M4 or M5.

Combining all of this knowledge with Nuturf's Disease Diagnosis services, a turf manager can know exactly where to position fungicide applications in the turf plant, and exactly which combination of products they should be using to gain the best possible control.

## Turf Fungicides

| Activity Group Code | Activity Group                    | Chemical Family   | Active Constituent | Trade Name                  | Previous Activity Group |
|---------------------|-----------------------------------|-------------------|--------------------|-----------------------------|-------------------------|
| 1                   | Methyl Benzimidazole Carbamates   | Benzimidazole     | thiabendazole      | Vorlon                      | A                       |
| 2                   | Dicarboximide                     | Dicarboximide     | iprodione          | Rovral GT<br>Transact       | B                       |
| 3                   | DMI                               | Imidazole         | prochloraz         | Protak 450EC                | C                       |
|                     |                                   | Triazole          | propiconazole      | Banner Maxx                 |                         |
|                     |                                   |                   | tebuconazole       | Dedicate                    |                         |
|                     |                                   | triadimenol       | Bayfidan           |                             |                         |
| 4                   | Phenylamide                       | Acylalanine       | metalaxyl-m        | Subdue Maxx                 | D                       |
| 7                   | Carboxamides                      | Phenyl benzamides | Flutalonil         | Moncut^                     | G                       |
| 11                  | Quinone outside Inhibitors (Qols) | Methoxy acrylate  | azoxystrobin       | Heritage Maxx               | K                       |
|                     |                                   | Oximino acetates  | trifloxystrobin    | Dedicate                    | K                       |
| 14                  | Heteroaromatics                   | 1,2,4-thiadiazole | etridiazole        | Terrazole                   | X                       |
| 28                  | Carbamate                         | Carbamate         | propamcarb         | Banol                       | Y                       |
| 33                  | Phosphonates                      | Ethyl phosphonate | Fosetyl-aluminium  | Signature                   | Y                       |
| M3                  | Multi-Site Activity               | Dithiocarbamate   | mancozeb           | Fore Rainshield<br>Mancoflo | Y                       |
|                     |                                   |                   | Thiram             | TMTD 600                    | Y                       |
| M4                  |                                   | Phthalimide       | Captan             | Captan 900                  | Y                       |
| M5                  |                                   | Chloronitriles    | chlorothalonil     | Daconil<br>Weatherstik      | Y                       |

(Ref – CropLife Australia Fungicide Resistance Management Review Group Activity Group Table as at 10 September, 2008.) NB. ^ = Currently under Permit for use in turf with APVMA.