STRATEGIES TO AVOID RESISTANCE DEVELOPMENT TO ANILOPYRIMIDINE FUNGICIDES IN NEW ZEALAND

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ABSTRACT

Anilopyrimidines have a site-specific mode of action and there is potential for resistance to develop in target plant pathogenic fungi. If resistance occurs, it is likely to arise through single-gene mutation. Resistance has not yet been recorded in New Zealand, but has been reported overseas in *Botrytis cinerea*, affecting grapes. Strategies developed under the auspices of the New Zealand Committee on Pesticide Resistance (NZCPR) to promote the use of anilopyrimidine compounds in a way which avoids or delays the development of resistance in pathogens of apple, grape and stonefruit crops in New Zealand are described.

Keywords: fungicide resistance management, plant diseases, cereals, vegetables, fruit crops.

INTRODUCTION

Anilopyrimidines were first marketed in Europe in the early 1990s. Of the three commercially available active ingredients, cyprodinil has high activity against cereal diseases, such as powdery mildew and eyespot, whereas mepanipyrim and pyrimethanil have high activity against botrytis in grapes and black spot (scab) in apples (Leroux 1996). All three have a site-specific mode of action, which involves interference with the biosynthesis of the amino acid methionine (Masner *et al.* 1994), and the inhibition of secretion of hydrolytic enzymes (Milling *et al.* 1993; Miura *et al.* 1994). Anilopyrimidines are believed to form a separate cross-resistance group, such that fungi showing resistance to one compound within the group will show resistance to other compounds within the group, but not to compounds outside the group. Only cyprodinil and pyrimethanil are currently registered for use in New Zealand.

This paper describes strategies recommended for the use of anilopyrimidine fungicides in New Zealand to avoid or delay the development of resistance in target plant pathogens. These strategies have been developed under the auspices of the New Zealand Committee on Pesticide Resistance (Elliot *et al.* 1987), and are based on recommendations from the Fungicide Resistance Action Committee (FRAC, Anon. 1998).

PRODUCT PERSPECTIVE

Products

Different anilopyrimidine products have label claims for use in different crops and product labels must be consulted. Anilopyrimidines currently registered for use in New Zealand are cyprodinil, as Chorus (Novartis New Zealand Ltd), cyprodinil/fludioxonil as Switch (Novartis New Zealand Ltd) and pyrimethanil, as Scala (BASF New Zealand Ltd). Formulations include suspension concentrate (Scala) and water dispersible granules (Chorus, Switch). These fungicides have protective and curative activity. Fludioxonil, which is included in Switch, is a phenylpyrrole fungicide that has a different mode of action to the anilopyrimidines (Forster and Staub 1996).

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Target pathogens and crops

The pathogens and crops for which these products have label claims in New Zealand are: *Botrytis cinerea* (grape grey mould and apple dry eye rot); *Venturia inaequalis* (apple black spot); *Podosphaera leucotricha* (apple powdery mildew) and *Monilinia* spp. (stonefruit blossom blight and brown rot).

Current and new records of resistance

To date there have been no instances of anilopyrimidine resistance recorded in New Zealand. Resistance has been found in *B. cinerea* in Europe and has been shown to involve a single gene mutation resulting in a qualitative shift in sensitivity in field isolates and field resistance involving a loss of disease control (Hilber and Hilber-Bodmer 1998). In *V. inaequalis*, sensitivity monitoring has not revealed field resistance to anilopyrimidines (Kunz *et al.* 1998).

ANILOPYRIMIDINE MANAGEMENT STRATEGY

General resistance management guidelines

1. Observe manufacturers' recommendations for application rate and timing, and the maximum numbers of applications of anilopyrimidine products for specific crops. Reduced rate applications should be avoided.
2. Apply anilopyrimidines when disease levels are low.

Apples for black spot

1. A maximum of 4 applications may be used per season of products where an anilopyrimidine is the only fungicide active ingredient in the spray mix.
2. Where spray programmes include anilopyrimidines applied in mixture with a fungicide from a different cross-resistance group, a maximum of 5 anilopyrimidine applications per season may be used.
3. Different anilopyrimidine active ingredients (cyprodinil and pyrimethanil) count towards the above maximum recommended numbers of applications.
4. Use anilopyrimidine-containing products early in the season while fruit are small and while temperatures are cool.

Grapes for botrytis

1. Where up to 6 botrytis-specific treatments are applied to a crop in a season, a maximum of 2 applications with anilopyrimidine containing products may be used, and if more than 6 botrytis-specific treatments are applied, a maximum of 3 applications with anilopyrimidine containing products may be used.
2. For specific products, follow the use recommendations on individual labels.

Stonefruit for brown rot/blossom blight

1. A maximum of 4 applications of anilopyrimidine containing products per season may be used during the blossom period and during the rest of the season, products containing non-anilopyrimidine active ingredients should be used.
2. It is preferable to alternate each anilopyrimidine application with a product containing a non-anilopyrimidine active ingredient (e.g. a triazole fungicide).

Implementation

A resistance management statement should be included on all product labels for anilopyrimidine compounds outlining the risks associated with excessive use and the appropriate usage guidelines for specific crops and diseases to avoid resistance.

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