

## Report of the Control Strategies Subgroup meeting on 17 May 2017

RUAIRIDH BAIN, CLAIRE KENNEDY

SRUC, John Niven Building, Auchincruive Estate, Ayr, Scotland KA6 5HW, UK

### 1. ALTERNARIA BLIGHT

#### 1.1 Changes to the early blight fungicide efficacy table

Three action points from the Brasov meeting were addressed. **1.** A new ratings table containing objective and trials-based efficacy ratings has replaced the previous table comprising subjective ratings. The positioning of the new table solves the issue of poor links in the EuroBlight website to the early blight fungicide table. **2.** The dose rates of the fungicides with ratings generated from the early blight efficacy ratings trials are included in the new table. **3.** Comments on insensitivity risk are now included in the footnotes to the table.

There is one outstanding action point from the Brasov meeting: the inclusion of a footnote explaining the transgression of product labels, in terms of number of fungicide applications, in the ratings trial protocol.

#### 1.2 *Alternaria* subgroup

Proposal: The *Alternaria* subgroup was requested to take charge of any action points appropriate to early blight aspects of EuroBlight. The subgroup should address action points from the Brasov workshop onwards (Agreed).

### 2. PHYTOPHTHORA BLIGHT

#### 2.1 Changes to the late blight fungicide efficacy table

Prior to the Aarhus workshop Syngenta requested that the EuroBlight fungicide experts give ratings (0 to +++) for the co-formulation of mandipropamid + cymoxanil (Carial Flex) based on the experts' experience with this product and also information provided by Syngenta. These scores were added to the table.

The provisional leaf blight efficacy rating of 4.6 was assigned to [zoxamide + dimethomorph (Presidium)] + fluazinam and included in the late blight table. The rating is provisional because it is based on five trials, not six.

At the Aarhus meeting it was stated that none of the fungicide registration dates listed in the table had been questioned and therefore no updates were required.

### *2.2 Ratings trials*

Up to the time of the Aarhus meeting there had been no reports made to EuroBlight of reduced efficacy for specific fungicides in relation to their EuroBlight ratings. Any future reports should be addressed to Huub Schepers and include supporting evidence.

No host resistance elicitors were included in the 2015 or 2016 trials for efficacy ratings because none were submitted for inclusion by companies.

Proposal: Tank mixes of fungicide and adjuvant should be included in the EuroBlight efficacy table (Not agreed).

In 2017 the late blight leaf blight efficacy trials will be in DK, NL and UK.

### *2.3 New initiatives and developments*

The Best Practice guides are to be revised, for Europe initially. Volunteers for this task were requested and Ruairidh Bain and Faye Ritchie agreed to assist Huub. The completed European-centred guides, containing more detail and better quality information, will be put on the EuroBlight website. Subsequently the guides will be adapted for other continents. Ivette Acuña and Jorge Andrade-Piedra offered to help with this.

## **3. GENERAL POINTS**

All of the protocols previously available on the two older websites need to be transferred onto the new EuroBlight website and then updated if necessary. This is required not only for members of EuroBlight but to facilitate the sharing of protocols with researchers in other blight networks. At the Aarhus meeting there was a request specifically for the fungicide rainfastness protocol.

Issues remain over the links on the EuroBlight website to the websites for Africa Blight, Asia Blight, Tizon Latino and US Blight and also the amount of information about these four other networks on the EuroBlight website.

Detailed information for the eleven Best Practice items in the Control Strategies section of the website was absent.

## **4. RECORD OF FUNGICIDE TABLES**

The most up to date versions of the late blight and *Alternaria* fungicide efficacy tables should be accessed via the EuroBlight website. The fungicides tables in this paper are a record of the tables as at September 2017.

### *GENERAL COMMENTS ABOUT THE RATINGS TABLE FOR LATE BLIGHT FUNGICIDES*

Ratings are intended as a guide only and will be amended in future if new information becomes available. Ratings for leaf blight control are based on results from EuroBlight field trials, and only compounds included in these trials are rated for leaf blight. The scale for leaf blight is a 2-5 scale (see technical report: Fungicide evaluation to rate efficacy to control leaf late blight for the

EuroBlight table. Results 2006 – 2015). Ratings for tuber blight control are also based on results from dedicated EuroBlight field trials and only compounds included in these trials are rated for tuber blight. The scale for tuber blight is a 0-5 scale (see technical report: Fungicide evaluation to rate efficacy to control tuber blight for the EuroBlight table. Results 2009-2011). Ratings for leaf blight and tuber blight control are each calculated from the results of a minimum of six EuroBlight field trials. There are few products with decimal ratings for tuber blight control compared with earlier subjective ratings but the 0 to +++ ratings can be obtained from the previous workshop proceedings.

All other ratings in the table are on a 0 to +++ scale. These ratings are derived from non-EuroBlight field experiments and experience of the performance of products when used in commercial conditions.

The ratings given are for late blight fungicides currently registered in several EU countries and are for commercially available products containing one active ingredient, or two active ingredients as a co-formulated mixture, or tank mix on the product label. The ratings are NOT for the active ingredients themselves. The ratings given are for the highest dose rate registered for the control of *P. infestans* in Europe. Different dose rates may be approved in different countries.

The scores for individual products are not additive for mixtures of active ingredients. The dose rates in brackets are those used in the EuroBlight field trials to determine the leaf blight and tuber blight ratings. Ratings will be lower where fungicide insensitive strains are present.

#### *GENERAL COMMENTS ABOUT THE RATINGS TABLE FOR ALTERNARIA FUNGICIDES*

See the footnotes to the table. The scores for individual products are not additive for mixtures of active ingredients. The dose rates are those used in the six EuroBlight field trials necessary to determine the leaf blight ratings. The ratings given are for fungicides with an efficacy against early blight currently registered in several EU countries and are for commercially available products. The ratings are NOT for the active ingredients themselves.

### **DEFINITIONS (REPRODUCED FROM THE TALLINN 2005 PROCEEDINGS)**

#### *PHENYLAMIDE RESISTANCE*

The ratings assume a phenylamide-sensitive population. Strains of *P. infestans* resistant to phenylamide fungicides occur widely within Europe. Phenylamide fungicides are available only in co-formulation with protectant fungicides and the contribution that the phenylamide component makes to overall blight control depends on the proportion of resistant strains within the population.

#### *NEW GROWTH*

The ratings for the protection of the new growing point (new growth) indicate the protection of new foliage due to systemic or translaminar movement or the redistribution of a contact fungicide. New growth consists of growth and development of leaves present at the time of the last fungicide application and/or newly formed leaflets and leaves that were not present.

*PROTECTANT ACTIVITY*

Spores killed before or upon germination/penetration. The fungicide has to be present on/in the leaf/stem surface before spore germination/penetration occurs.

*CURATIVE ACTIVITY*

The fungicide is active against *P. infestans* during the immediate post infection period but before symptoms become visible.

*ANTISPORULANT ACTIVITY*

*P. infestans* lesions are affected by the fungicide decreasing sporangiophore formation and/or decreasing the viability of the sporangia formed.

*STEM BLIGHT CONTROL*

Effective for the control of stem infection, either by direct contact or via systemic activity.

*TUBER BLIGHT CONTROL*

Activity against tuber infection as a result of fungicide application after infection of the haulm, during mid- to late-season i.e. where there is a direct effect on the tuber infection process. The effect of phenylamide fungicides on tuber blight control was therefore not considered relevant in the context of the table as these materials should not be applied to potato crops if there is blight on the haulm, according to FRAC guidelines. Only the direct (biological) effect of a particular fungicide on the tuber infection process was considered relevant and NOT the indirect effect as a result of manipulation or delay in the development of the foliar epidemic.

**Late Blight Fungicide Table** The effectiveness of fungicide products and label mixtures for the control of *P. infestans* based on the highest dose rate registered in Europe (as at September 2017)

Product [Dose rate (l or kg/ha)]	Effectiveness			Mode of Action			Rainfastness	Mobility in the plant	Year	
	Leaf Blight <sup>3</sup>	New growth	Stem blight	Tuber blight <sup>4</sup>	Protectant	Curative				Anti-sporulant
copper			+		+(+)	0	0	+	contact	1900
dithiocarbamates (2.0) <sup>1</sup>	2.0		+	0.0	++	0	0	+(+)	contact	1961
chlorothalonil			(+)		++	0	0	++(+)	contact	1964
cyazofamid (0.5)	3.8	++	+	3.8	+++	0	0	+++	contact	2001
fluzinam (0.4)	2.9		+		+++	0	0	++(+)	contact	1992
zoxamide+mancozeb (1.8)	2.8		+ <sup>5</sup>		+++	0	0	++(+)	contact+contact	2001
amisulbrom+mancozeb (0.5+2.0)	4.5		+	3.7	++(+)	0	?	+++	contact+contact	2007
ametoctradin+ <b>mancozeb</b> (2.5)	3.7	?	?		++(+)	0	0	+++	contact+ <b>contact</b>	2011
famoxadone+ <b>cymoxanil</b>			+(+)		++	++	+	++(+)	contact+translaminar	1996
mandipropamid (0.6)	4.0	++	+(+)		+++	+ <sup>6</sup>	+(+)	+++	contact/translaminar	2005
mandipropamid + difenoconazole (0.6)	4.0	++	+(+)		+++	+ <sup>6</sup>	+(+)	+++	contact/translaminar+contact	2005
benthiavalicarb + <b>mancozeb</b> (2.0)	3.7		+(+) <sup>5</sup>		+++	+(+)	+	++(+)	translaminar+ <b>contact</b>	2003
cymoxanil+ <b>mancozeb</b>			+(+)		++	++	+	++	translaminar+ <b>contact</b>	1976
cymoxanil+ <b>metiram</b>			+(+)		++	++	+	++	translaminar+ <b>contact</b>	1976
cymoxanil+ <b>copper</b>			+(+)		++	++	+	++	translaminar+ <b>contact</b>	1976
dimethomorph+ <b>mancozeb</b> (2.4)	3.0		+(+)		++(+)	+	++	++(+)	translaminar+ <b>contact</b>	1988
dimethomorph+fluzinam (1.0)	3.7	+	+	3.3	++(+)	+	++	++(+)	translaminar+contact	2012
fenamidone+ <b>mancozeb</b> (1.5)	2.6		+(+) <sup>5</sup>		++(+)	0	+(+) <sup>5</sup>	++	translaminar+ <b>contact</b>	1998
(zoxamide+cymoxanil)	4.3								contact/translaminar+contact	2013
+fluzinam (0.45 + 0.4)										
(zoxamide+ dimethomorph)	4.6 <sup>9</sup>								contact/translaminar+contact	2015
+fluzinam (1.0 + 0.4)										
mandipropamid+cymoxanil (0.6)	4.4	++	+(+)		+++	++	+(+)	+++	contact/translaminar+	2013
									translaminar	
benalaxyl-M+ <b>mancozeb</b> <sup>2</sup>	3.0	++	++		++(+)	++(+)	++(+)	+++	systemic+ <b>contact</b>	1981
metalaxyl-M+ <b>mancozeb</b> <sup>2</sup>		++	++		++(+)	++(+)	++(+)	+++	systemic+ <b>contact</b>	1977
metalaxyl-M+ <b>fluzinam</b> <sup>2</sup>		++	++		++(+)	++(+)	++(+)	+++	systemic+ <b>contact</b>	
(propamocarb+cymoxanil)									systemic+translaminar+	2012
+ cyazofamid ((2.0)+0.5)				4.6					contact	

Product [Dose rate (l or kg/ha)]	Effectiveness				Mode of Action			Rainfastness	Mobility in the plant	Year
	Leaf Blight <sup>3</sup>	New growth	Stem blight	Tuber blight <sup>4</sup>	Protectant	Curative	Anti-sporulant			
propamocarb+cymoxanil (2.0)					+(+)	++(+) <sup>7</sup>	++(+)		systemic+translaminar	2011
propamocarb-HCl+ <b>fenamidone</b> (2.0)	2.5	+(+)	++		++(+)	++	++	+++	systemic+ <b>translaminar</b>	1998
propamocarb-HCl+ <b>fluopicolide</b> (1.6)	3.8	++	++	3.9	+++	++	++(+)	++(+)	systemic + <b>translaminar</b>	2006
oxathiapiprolin (0.15)		++(+)	++(+)		+++	++	++(+)	+++	systemic	2017

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Footnotes to Late Blight Fungicide Table

See caveats listed in the section entitled 'General comments about the ratings table for late blight fungicides'

<sup>1</sup> Includes maneb, mancozeb, propineb and metiram.

<sup>2</sup> See text for comments on phenylamide resistance.

<sup>3</sup> Based on EuroBlight field test in 2006-2015.

<sup>4</sup> Based on EuroBlight field trials 2009-2012

<sup>5</sup> Based on limited data.

<sup>6</sup> In some trials there were indications that the rating was +(+).

<sup>7</sup> In some trials the curative activity was +++

<sup>8</sup> Observations from some trials indicated that both new growth and stem blight efficacy were ++

<sup>9</sup> A provisional rating based on five EuroBlight experiments.

Key to ratings : 0 = no effect ; + = reasonable effect ; ++ = good effect ; +++ = very good effect ;

Blank = no rating

The scale for leaf blight is a 2 to 5 scale (2=least effective, 5= most effective).

The scale for tuber blight is 0 (no effect) to 5 (complete control).

**Disclaimer** : See section on phenylamide resistance. Isolates of *P. infestans* have been found in parts of Europe resulting in lower field efficacy of fluazinam. Whilst every effort has been made to ensure that the information is accurate, no liability can be accepted for any error or omission in the content of the tables or for any loss, damage or other accident arising from the use of the fungicides listed herein. Omission of a fungicide does not necessarily mean that it is not approved for use within one or more EU countries. It is essential to follow the instructions given on the approved label of a particular blight fungicide appropriate to the country of use before handling, storing or using any blight fungicide or other crop protection product.

**Early Blight Fungicide Table** Efficacy of fungicides for the control of early blight caused by *Alternaria solani* and *Alternaria alternata* (as at September 2017)

Product	Efficacy rating <sup>1,2</sup>		
	14-day interval	Strategy	7-day interval
<b>Spray interval 14 days</b>			
mancozeb 2.0	1.7	-	-
<b>Spray strategy<sup>3</sup></b>			
(zoxamide + mancozeb) <sup>a</sup> 1.8 + azoxystrobin <sup>b,5</sup> 0.5 <sup>4</sup>	-	3.7	-
(zoxamide + mancozeb) <sup>a</sup> 1.8 + difenoconazole <sup>a</sup> 0.5	-	3.9	-
<b>Spray interval 7 days</b>			
mancozeb 2.0	-	-	2.5
zoxamide + mancozeb 1.8	-	-	2.8
fenamidone <sup>5</sup> + propamocarb 2.0	-	-	2.2
fluazinam + azoxystrobin <sup>5</sup> 0.5	-	-	3.1
dimethomorph + mancozeb 2.0	-	-	2.9

<sup>1</sup> Ratings for *Alternaria* are based on results from EuroBlight field trials during 2015-2016, and only compounds included in these trials are rated for *Alternaria*. The scale for *Alternaria* is a 0-5 scale.

<sup>2</sup> The ratings are intended as a guide only and will be amended in future if new information becomes available.

<sup>3</sup> The active ingredients were sprayed in a spray strategy with a 7 day interval (<sup>a</sup>) or a 14 day interval (<sup>b</sup>).

<sup>4</sup> azoxystrobin was sprayed at label rate which is 0.5 for DK and DE, and 0.25 for NL.

<sup>5</sup> *Alternaria solani* isolates that are less sensitive to QoI-fungicides have been isolated from potato plants in Europe. Therefore resistance management strategies should be implemented (see FRAC web site for details). Ratings will be lower where fungicide insensitive strains are present.

**Disclaimer:** Whilst every effort has been made to ensure that the information is accurate, no liability can be accepted for any error or omission in the content of the table or for any loss, damage or other accident arising from the use of the fungicides listed herein. Omission of a fungicide does not necessarily mean that it is not approved for use within one or more EU countries. The ratings are based on the national dose rate label recommendation for a particular product. Where the disease pressure is low, intervals between spray applications may be extended and, in some countries, fungicide applications are made in response to nationally issued spray warnings and/or Decision Support Systems. It is essential therefore to follow the instructions given on the approved label of a particular early blight fungicide appropriate to the country of use before handling, storing or using any early blight fungicide or other crop protection product.