Guidance on how the potato industry should respond to reduced fluazinam sensitivity in late blight populations

1 Changes in late blight sensitivity to fluazinam
Populations of the potato late blight pathogen *Phytophthora infestans* have undergone several notable changes in the last few decades in Great Britain. There was the appearance of phenylamide-resistant strains in 1981, shortly after this fungicide mode of action was approved for use. More recently, cultivar resistance ratings of previously late blight-resistant varieties were downgraded due to the dominance of more aggressive and virulent genotypes such as 13_A2 (Blue 13) in GB populations.

Fluazinam was first available for use against *P. infestans* in Europe in 1992 and a strain (33_A2, Green 33) with decreased sensitivity to this fungicide was reported in the Netherlands in 2009. In 2011 and 2012, the same strain was reported at low frequency in GB, as part of AHDB’s Fight against Blight monitoring, but was rarely detected in subsequent years due to a suspected fitness penalty.

In June 2017, results reported by Wageningen University & Research in the Netherlands showed that all *P. infestans* isolates tested of the recently found 37_A2 (Dark Green 37) genotype were associated with decreased sensitivity to fluazinam. The researchers concluded that there is a strong indication that the rise of 37_A2 in Europe is in part caused by a selection advantage where fluazinam is used (i.e. in the presence of fluazinam, the strain is better able to infect, grow and reproduce than strains which are sensitive to the fungicide). The 37_A2 genotype was found in GB as part of AHDB Fight against Blight monitoring in 2016, representing 3% of the samples submitted by blight scouts. However, by 2017, 24% of the samples submitted were 37_A2.

Fungicides are a key part of late blight management, therefore it is important that appropriate resistance management strategies are put in place to reduce selection for strains with decreased sensitivity to fungicides. Also, there is a risk that control by fluazinam will be adversely affected in areas where 37_A2 is present, thus putting the crop at risk from foliar and tuber blight.

These notes provide a summary of the most up to date information relevant to maintaining control of late blight in GB, now strains with known decreased sensitivity to fluazinam have been found. This includes information derived from general principles applicable to fungicide resistance management. Information on insensitivity to other active ingredients is contained in the FRAG-UK guide (Fungicide Resistance Management in Potato Late Blight). It is important that actions taken to address reduced sensitivity to fluazinam don’t select for insensitivity to other actives.

2 What is an effective fungicide resistance management strategy?
Now that strains with decreased sensitivity to fluazinam are present in GB, there will be increased pressure on the remaining fungicidal modes of action, especially those with good tuber blight activity (Quinone inside Inhibitors, FRAC code 21, and the mode of action group containing fluopicolide, FRAC code 43). A good resistance management strategy should provide effective disease control whilst slowing the selection for resistant strains. Such strategies include careful choice of fungicide programmes and cultural control.
2.1 Fungicide resistance management: cultural control

Cultural control methods aim to delay or prevent initial exposure of the crop to *P. infestans* and include the management of outgrade piles, volunteers and seed as primary sources of late blight. These measures will help prevent the spread of late blight, decrease the number of spores produced as well as decrease the spread of strains with decreased sensitivity to fungicide into new crops. Oospores, which allow the survival of *P. infestans* in soil in the absence of the host, have not been confirmed as initiating late blight outbreaks in GB. AHDB monitoring has demonstrated that many samples from outgrade piles or volunteers, as well as crops, often contain more than one *P. infestans* mating type. This increases the risk of novel strains developing in this country, the production of oospores and the potential for earlier outbreaks than experienced currently. Outgrade piles should be monitored and steps taken to destroy haulm even where there is no evidence of late blight infection. Use heavy gauge black polythene to cover outgrade piles or destroy young haulm using recommended herbicides.

Volunteers can be a primary source of late blight as well as allowing the multiplication of late blight during the growing season on foliage untreated with fungicide. Given that 37_A2 has been implicated in tuber blight, it will be necessary to ensure new crops are not located near to fields where volunteers are likely to occur. Any plants that will not receive a fungicide spray should be considered a risk and be removed and disposed of. This includes small quantities of unplanted tubers left in fields after planting.

Research in continental Europe has shown oospores can survive for 48 months, therefore maintaining long rotations, free from volunteers, will be important in decreasing the potential for new strains to appear.

Variety choice is often determined by other market or agronomic factors, however, research conducted in GB has demonstrated that using a variety with good resistance to late blight, coupled with an appropriate fungicide programme can substantially decrease the number of spores produced in a crop and slow the spread of an epidemic. This can slow the rate at which new strains become dominant in the pathogen population.

Seed quality will be important, given that 37_A2 has been associated with tuber blight outbreaks and The James Hutton Institute has also detected this genotype causing tuber blight in GB-stored potatoes. There have been reports of 37_A2 in seed producing areas in England through AHDB Fight Against Blight monitoring. Genotype 37_A2 has also been reported on imported seed. In general, using classified seed stocks will help to decrease the risk of late blight in crops. Farm-saved seed can come with a range of risks and it is recommended to avoid using farm-saved seed if 37_A2 has been reported in the area or if late blight control with fluazinam in the parent crop was not as good as normal.

Key points for cultural control:

- Maintain longer rotations (at least 1 in 5) to mitigate against the threat from oospores in soil.
- Control potato volunteers in other crops;
- Prevent growth of foliage on potato outgrade piles;
- Locate new crops away from fields where volunteers are likely or outgrade piles are present;
- Use varieties with good resistance to *P. infestans* where possible;
- Source good quality seed.
2.2 Fungicide resistance management: chemical control

There are thirteen different modes of action available for late blight control, which is substantially more than currently available to control plant pathogens in many arable crops (Table 1). This is good news for implementing resistance management strategies. Ten of those modes of action have only one active ingredient used against late blight, however, many commonly used products belong to the same mode of action group. According to the most recent DEFRA Pesticide Usage Survey, the most frequently used active ingredients (including fluazinam) come from five out of the thirteen modes of action available. When putting spray programmes together, it is important to know which mode of action each fungicide belongs to, particularly to avoid repeated use of the same mode of action.

2.3 Implementing an effective resistance management strategy

There is evidence, based on scientific research on potato and many other crops, to guide strategies to slow the selection for fungal strains with decreased sensitivity to fungicides.

In most crops the first method of fungicide resistance management is to avoid use of fungicide unless the risk of disease makes an economic return likely. This avoids exposing the pathogen to the fungicide and creating resistance selection unnecessarily. However, this general recommendation is not particularly applicable to late blight for which treatment is often started in relation to crop growth stage, weather-based risk or reports of an outbreak in the locality. If there is disease present locally or a risk of initial inoculum and conducive conditions for infection, then fungicide treatment is required. If the pathogen is not present, then even if fungicide treatments might be unnecessary, they will not cause selection for resistance.

Repeated applications of single-site acting fungicides with the same mode of action increase the rate at which fungicide insensitive pathogen strains increase in the population, particularly when applied as solo products. Multi-site acting fungicides (such as mancozeb or chlorothalonil) have a low risk of resistance developing. Hence, multi-site fungicides are very important for alternating or mixing with other fungicides, to reduce resistance risk. Currently the main multi-site fungicide option is mancozeb. Chlorothalonil has reasonable activity against late blight, and is approved in a co-formulation with cymoxanil (maximum two applications of the product per crop permitted). However, the chlorothalonil dose is relatively low.

Fungicide mixtures, comprising co-formulations or tank mixtures of products with different modes of action, and at combined doses that will provide effective disease control, are important for resistance management. The components should ideally provide similar efficacy and persistence, so the fungicide application interval, as well as the duration of protection offered by different modes of action, should be considered. For example, combining a late blight product known to have shorter persistence (e.g. cymoxanil) to protect a product that will provide 7 days protection, does not represent a good strategy and an additional mixture partner representing a different mode of action, or ideally a multisite, should be considered in this situation. Most potato late blight products provide 7 days activity, however, some products have been shown to be active against late blight for up to 10 days e.g. metalaxyl-M and oxathiapiprolin. In this instance, there is no equivalent mixture partner that extends beyond seven days.

The inclusion of fluazinam in mixture with a different mode of action, particularly if it was a product with a single-site mode of action, would not be considered a good strategy where 37_A2 is present, because there would be high reliance on the partner product to control late blight.
2.4 Could the use of phenylamide fungicides help manage fluazinam resistance?

There is limited information on the sensitivity of 37_A2 to metalaxyl-M. We cannot confirm whether or not this genotype is sensitive or insensitive to phenylamides. Fubol Gold (mancozeb + metalaxyl-M) has not been used routinely for blight control since 13_A2 appeared and was confirmed to be metalaxyl resistant. 6_A1 (Pink 6) is known to be sensitive to phenylamides. If 37_A2 is sensitive then, in principle, metalaxyl could help control two important genotypes, if it was to be reintroduced into late blight programmes. However, such an approach may not be beneficial for two reasons. Firstly, more information on the phenylamide-resistance status of 37_A2 is required to ensure that metalaxyl is effective against all *P. infestans* that is genotype 37_A2. Secondly, strains with decreased sensitivity to phenylamide chemistry are already present in the GB population (predominantly 13_A2) and metalaxyl would select for such strains, rendering the phenylamides less effective over time. As there is a range of other modes of action that are effective against all current strains, it is unlikely that the re-introduction of phenylamide fungicides would benefit fungicide resistance management strategies.

3 Changes in *P. infestans* populations

3.1 Sexually reproducing versus asexual, clonal populations

In the Netherlands, a significant proportion of the *P. infestans* population reproduces sexually and other countries, such as Sweden, have *P. infestans* populations that are predominately sexual. Genotyping, funded by AHDB as part of ‘Fight Against Blight’, has demonstrated that part of the *P. infestans* population in Scotland is most probably reproducing sexually, but the GB population has been predominately clonal since monitoring began, resulting in a population consisting of only one or two dominant strains with particular genetic characteristics. The implications of sexual vs. asexual reproduction for resistance management have not yet been established. Asexual, clonal reproduction enables new pathogen genotypes to dominate the population very rapidly. Whereas sexual reproduction creates new combinations of aggressiveness, virulence and fungicide resistance. Whilst these effects are being investigated the practical message is to prevent sexual reproduction becoming more established in GB, because of the increased control problems it would be likely to bring.

3.2 Rapid changes in *P. infestans* genotype frequency

Prior to the mid-2000s, limited use of fungicide co-formulations containing phenylamides (e.g. metalaxyl-M) was continued because it was considered that GB *P. infestans* strains insensitive to phenylamides carried a fitness penalty. The appearance of 13_A2 in the mid-2000s changed this as the new genotype combined insensitivity to phenylamides with increased aggressiveness. Consequently the proportion of 13_A2 could remain high, even with in the absence of phenylamide products being applied.

The GB *P. infestans* population has been dominated by 13_A2 and 6_A1 since 2007 (Fig. 1). Both were proven to be more aggressive than previous strains and carried new virulences against late blight resistance genes in potato varieties. These genotypes were responsible for the downgrading of cultivar resistance ratings, and were able to displace the majority of other strains identified until 2016. Both strains increased in the population (13_A2 peaked in 2008 and 6_A1 in 2011) and subsequently declined.
A genotype associated with decreased sensitivity to fluazinam was first detected in GB in 2011, 33_A2, however it did not increase in frequency in the population and was rarely detected after 2012. Subsequently, research in the Netherlands confirmed that this strain had a fitness penalty which meant it was unable to compete with other strains successfully in the absence of fluazinam. In contrast, 37_A2 is increasing and was reported to represent 3% of the sampled population in 2016 and 24% in 2017. The evidence so far suggests that 37_A2, in addition to being less sensitive to fluazinam, has similar aggressiveness to 6_A1, so it is possible that this strain will increase in frequency and continue to spread, even if fluazinam use is reduced substantially.

![Fig. 1 Frequencies of P. infestans genotypes in GB, 2003 to 2017 (Cooke et al. AHDB Fight Against Blight monitoring)](image)

3.3 Intensity of current genotyping
The AHDB Fight Against Blight population monitoring uses samples taken voluntarily from late blight outbreaks across GB to identify pathogen genotypes. This analysis has provided useful information on changes to dominant strains and allowed targeted research on the likely effect of those strains on foliar blight control e.g. changes to variety foliar blight resistance ratings. It is important that representative samples are collected from across GB to track the distribution of different genotypes.

The intensity of sampling and the voluntary nature of the sample provision are not sufficient to confidently confirm the absence of a genotype, such as 37_A2, from a particular region. This limitation needs to be accounted for in decisions on practical late blight control – described in the next section.
4 Reducing the risk of crop damage from reduced effectiveness of late blight control

In areas where 37_A2 has already been confirmed, fluazinam use carries a risk of less effective late blight control and increased risk of tuber infection. These risks should be mitigated by using products other than fluazinam. In areas where 37_A2 has not been confirmed, the following risk factors should be fully considered before use of fluazinam:

- Geographical location of crops, i.e. 37_A2 confirmed in region or not. Consider if sampling intensity in the area is sufficient to avoid false negatives (i.e. that 37_A2 has not been detected, but is in fact present).
- Seed source used for your crops and others in the locality. Did it originate from a region in which 37_A2 has been confirmed? This comment applies to imported seed plus UK seed.
- Is fluazinam needed for Sclerotinia control?
- Is the crop to be desiccated and stored (and hence at higher risk from soft rots originating from blighted tubers) or harvested green top and marketed immediately?
- Consider who carries the risk if fluazinam is used and there is loss of control linked to resistance.

The distribution of samples of leaf blight (2017) and tuber blight (2017/2018 storage season) confirmed as containing 37_A2 in GB is shown in Fig.2.

Fig.2 GB distribution of 37_A2 outbreaks in the 2017 season, indicated by dark green dots (Cooke et al., The James Hutton Institute, as at March 2018). Map generated on www.euroblight.net
5  Tuber blight control and decreased sensitivity to fluazinam

The efficacy of fluazinam is likely to be adversely affected if 37_A2 comes to dominate the population. There are thirteen modes of action for late blight control in the UK (Table 1), however, only three modes of action are considered to have very good activity against zoospores and therefore against tuber blight. Fluazinam is often incorporated into fungicide programmes for foliar blight control and particularly for protection against tuber blight. There are two issues affecting tuber blight control if fluazinam becomes less effective: (i) a reliance on fewer modes of action and (ii) how to use the remaining modes of action for fungicide resistance management, especially elsewhere in the fungicide programme.

Table 1. The thirteen FRAC modes of action (MOA), and their insensitivity risk, that are currently available for potato late blight control in the UK

<table>
<thead>
<tr>
<th>FRAC code</th>
<th>4</th>
<th>11</th>
<th>21</th>
<th>22</th>
<th>28</th>
<th>40</th>
<th>27</th>
<th>29</th>
<th>M3</th>
<th>M5</th>
<th>43</th>
<th>45</th>
<th>49</th>
</tr>
</thead>
<tbody>
<tr>
<td>Late blight a.i.s in MOA</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>metalaxyl-M³</td>
<td>Qol</td>
<td>Qil¹</td>
<td>zoxamide</td>
<td>propamocarb</td>
<td>CAA</td>
<td>cymoxanil</td>
<td>fluazinam ³</td>
<td>mancozeb</td>
<td>chlorothalonil</td>
<td>fluopicolide ¹</td>
<td>ametoctradin</td>
<td>oxathiapiprolin</td>
<td></td>
</tr>
</tbody>
</table>

¹ Known to be strongly effective against tuber blight

² Insensitivity risk: high (H), medium to high (MH), low to medium (LM), low (L), resistance risk unknown but assumed to be medium to high (?).

³ Some genotypes in GB have been strongly associated with reduced sensitivity, i.e. metalaxyl-M (13_A2) and fluazinam (33_A2 and 37_A2). An active ingredient will be less effective where the less-sensitive genotype is present.

⁴ There is no cross resistance between a.i.s with different FRAC codes

If fluazinam becomes ineffective, this will result in only two modes of action, i.e. Quinone inside inhibitor – Qil (FRAC code 21) and the group containing fluopicolide (FRAC code 43) remaining for the most effective tuber blight control and therefore a reliance on limited products e.g. Infinito (propamocarb-hydrochloride + fluopicolide), Ranman Top (cyazofamid) and Shinkon (amisulbrom). Both cyazofamid and amisulbrom are in the same mode of action group (Quinone inside inhibitor – Qil, code 21) therefore cannot be used in alternation or mixtures with each other as part of an effective fungicide resistance management strategy. Amisulbrom (as Gachinko) is also
recommended as a mixture partner, along with Rhapsody or Curzate M (mancozeb + cymoxanil), for Zorvec Enicade (oxathiapiprolin) which is likely to be applied during rapid canopy growth. If amisulbrom is used in this way, it will further restrict the options for tuber blight control later in the season. An example of this is given in Table 2. Similarly Ranman Top is also frequently used prior to the tuber protection phase of crop growth. To ensure an effective resistance management strategy for tuber blight control, careful planning of where to use particular modes of action will be required. Repeated application of products with the same mode of action is a poor resistance management strategy; alternating products will represent a more effective strategy.

Table 2. Maximum permissible number of applications of Infinito, Ranman Top (Qil) and Shinkon (Qil) per crop per season for tuber blight control following the use of Qil-containing treatments during rapid canopy growth

<table>
<thead>
<tr>
<th>Product</th>
<th>Application rate kg or l/ha</th>
<th>No. of applications of Qil during rapid haulm growth</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Zero</td>
</tr>
<tr>
<td>Ranman Top</td>
<td>0.5</td>
<td>3</td>
</tr>
<tr>
<td>Infinito</td>
<td>1.6</td>
<td>4</td>
</tr>
<tr>
<td>Shinkon</td>
<td>0.5</td>
<td>3</td>
</tr>
</tbody>
</table>

| Total number of tuber blight sprays | 10 | 8 | 7 |

6 Options to improve tuber blight control

6.1 New chemistry against tuber blight
There are no new active ingredients with zoospore activity that will be approved for tuber blight control in the 2018 season.

6.2 Enhanced foliar blight control, especially during stable canopy
Field trials on tuber blight control have shown that effective control of tuber blight is related to the effectiveness of foliar blight control.

Foliar blight control during stable canopy can be very significantly improved through, for example:

a) Using a fungicide with a higher EuroBlight rating;
b) Adding an additional fungicide to the spray tank;
c) Tank mixing the anti-drift agents Crusade or Sterling with certain fungicides;
d) Using a forecasting scheme to time fungicide applications shortly before a high-risk weather period;

Avoiding the need for eradicant use of fungicides and maintaining effective fungicide protection until the foliage and stems are dead reduce the risk of tuber blight.
6.3 Optimise use of existing chemistry

Better control of foliar blight during stable canopy was listed above as one measure to help reduce the risk of tuber blight. The improved control will reduce the amount of inoculum available to infect tubers. Likewise, fungicides with good EuroBlight ratings for anti-sporulant activity could also contribute to reduced inoculum. The EuroBlight fungicide table identifies some fungicides that could be useful mixture partners for straight QIs.

Tank mixes of tuber blight fungicide products have up to now been rare and few have been tested in trials. Their efficacy and compatibility, and also support for their use from manufacturers, would need to be checked. The number of tuber blight fungicide applications that can be made to any crop will depend on what extent QIs and fluopicolide are used during rapid canopy growth. Long-season crops may require the use of zoospore-active fungicides to be avoided during rapid haulm growth.

As already stated, if fluazinam becomes ineffectual the most effective control of tuber blight will depend on only two modes of action. Additional, alternative modes of action would boost resistance management. Zoxamide- and ametoctradin-containing products would add two different zoospore-active FRAC modes of action to the two that fluopicolide, cyazofamid, and amisulbrom provide. However, the tuber blight efficacy of these two additional modes of action is generally limited compared with products containing fluopicolide, amisulbrom or cyazofamid, or fluazinam products assuming the P. infestans is fluazinam sensitive.

6.4 Match interval from desiccation to harvest to varietal resistance to tuber blight

Infection of tubers by P. infestans can occur at harvest when viable P. infestans sporangia enter wounds. After desiccation of blighted crops the number of viable sporangia in the soil declines. Fewer viable sporangia are required to infect very susceptible tubers compared with more resistant ones. The standard advice of not harvesting a crop until the haulm has been dead for 14 days may allow most varieties to be harvested safely but varieties with particularly susceptible tubers may still be at risk. Harvest should be delayed.

The standard non-fungicide options for tuber blight control also apply, for example:

- Use blight-free seed
- Ensure sufficient soil cover over progeny tubers
- Avoid ridge cracking
- Achieve good haulm desiccation to prevent blighted re-growth

7 Fluazinam and Sclerotinia control

Fluazinam also provides incidental control of Sclerotinia stem rot. Typically, applications that protect against Sclerotinia will be applied between June and August, depending on weather risk and crop growth stage. If fluazinam is to be used for Sclerotinia control predominantly, particularly in areas where 37_A2 has been confirmed and late blight risk is low, it should be used mixed with a multi-site fungicide that is active against late blight, as a minimum. Where late blight risk is high and tuber blight control is required as well as Sclerotinia control, fluazinam should be applied with a multi-site fungicide as well as an additional late blight product to provide tuber blight protection. Whilst such an approach may seem excessively complex and costly, this would be the only way to protect the crop in the presence of strains with decreased sensitivity to fluazinam, by providing an alternative mode of action for late blight control.
Products which are applied for *Alternaria* control, such as Signum (containing boscalid, a succinate dehydrogenase inhibitor (SDHI) fungicide which is known to have activity against *Sclerotinia* in other crops) may provide incidental control of *Sclerotinia*. It should be noted that strains of *Sclerotinia* with decreased sensitivity to SDHI fungicides have been confirmed in France.

*Sclerotinia* poses a wider risk to other crops in the rotation, such as oilseed rape, peas and carrots. Cultural methods of *Sclerotinia* control, such as extending rotations and limiting the number of crops in the rotation that are susceptible, can decrease *Sclerotinia* risk and are likely to become more important if fluazinam is not used for control on potato. An effective strategy to limit the number of sclerotia returned to the soil is to provide good control of *Sclerotinia* in other host crops, for example, oilseed rape. This can be achieved by timing fungicides more effectively during flowering. Spray timing guidance for oilseed rape, based on *Sclerotinia* infection risk conditions, is available from the AHDB website. It is possible that this risk model could be tested to see if it, or a similar system, could be useful for potato. This would provide guidance for growers and help to decrease unnecessary applications of fluazinam or other products for *Sclerotinia* control.

8 Fluazinam and powdery scab control

Another aspect that may need to be considered as part of a fungicide resistance management strategy is the exposure of *P. infestans* zoospores to straight fluazinam when some of the planted seed is blighted and the soil had been treated at planting with fluazinam, in accordance with the Extension of Authorisation for Minor Use (EAMU) for the control of powdery scab. Some fluazinam products can be used for powdery scab control and, given that 37_A2 has been associated with tuber blight, it is possible that it will be present in the seed planted for some crops. Whether the exposure of *P. infestans* from blighted seed tubers to fluazinam in the soil selects for strains with decreased sensitivity has not been demonstrated. The potential for selection pressure exerted by soil-applied fluazinam on *P. infestans* may need to be reconsidered if it is demonstrated that oospores in commercial seed crop fields are contributing to late blight epidemiology in the UK.

9 Recommendations for resistance management and late blight control

- Implement cultural controls
- Prevent oospores contributing to late blight epidemiology by having long rotations (at least 1 in 5 and free from volunteers) and also by maintaining a high level of late blight control
- In areas in which genotype 37_A2 has been confirmed, there is increased risk of crop damage due to late blight if fluazinam is used and proves ineffective.
- In regions thought to be free from 37_A2 (but be aware of the potential for a rapid change in status) fully consider the risk of using fluazinam (see section 4)
- Plan an appropriate strategy across the entire fungicide programme which will protect foliage and tubers from late blight, and provide good resistance management
- Place much greater emphasis on modes of action when choosing products. Make full use of the different modes of action available; especially during the tuber protection phase of growth
• Using mixtures of fungicides with different modes of action (tank mixes or co-formulations) and alternating products throughout the fungicide programme are both effective resistance management strategies.
• Ensure mixing partners are used at doses that provide similar efficacy and persistence.
• Recent research in The Netherlands, with the less aggressive, fluazinam-insensitive genotype 33_A2, found that cymoxanil was ineffective at slowing the increase in fluazinam insensitivity when used as the only mixture partner with fluazinam.
• Avoid repeated application of the same product or mode of action and never exceed the label recommendation.
• Multisite fungicides, e.g. mancozeb, should be used where possible throughout the fungicide programme.
• The reliance on zoospore-active fungicides to control tuber blight can be reduced by: boosting foliar blight control during stable canopy; the inclusion of fungicides with good anti-sporulant activity; ensuring the haulm is protected until dead; preventing regrowth of haulm and by taking account of varietal resistance to tuber blight when deciding how soon to harvest after desiccation.
• Consider possible selection pressure on *P. infestans* from the use of fluazinam soil treatments.

10 Sources of information for regular updates
• AHDB Potato Variety Database
• AHDB Potatoes: Managing the risk of late blight guidelines (published 2013)
• EuroBlight table of fungicides
• FRAC list for current year
• Fight Against Blight website

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