

## **Efficacy of fluazinam for control of potato late blight (*Phytophthora infestans*) in Danish field trials**

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### **SUMMARY**

Shirlan (fluazinam) and mancozeb-based products were for many years the main products used for control of potato late blight (*Phytophthora infestans*) in Denmark. In 2006-2007 field trials were seen for the first time in which a significantly lower effect of Shirlan against late blight was observed. The low effect was mainly seen in field trials with artificial inoculation at Research Centre Flakkebjerg (AU). Improved effect of Shirlan was seen from 2008 when isolates for use as artificial inoculation were changed but there was still a large variation in efficacy (2012 with very high effect). The use of Shirlan has declined drastically since 2008, and Shirlan is now only recommended when the risk of infection is low and the active new growth of the potato plant is limited.

### **KEYWORDS**

Potato late blight, *Phytophthora infestans*, disease control, fluazinam

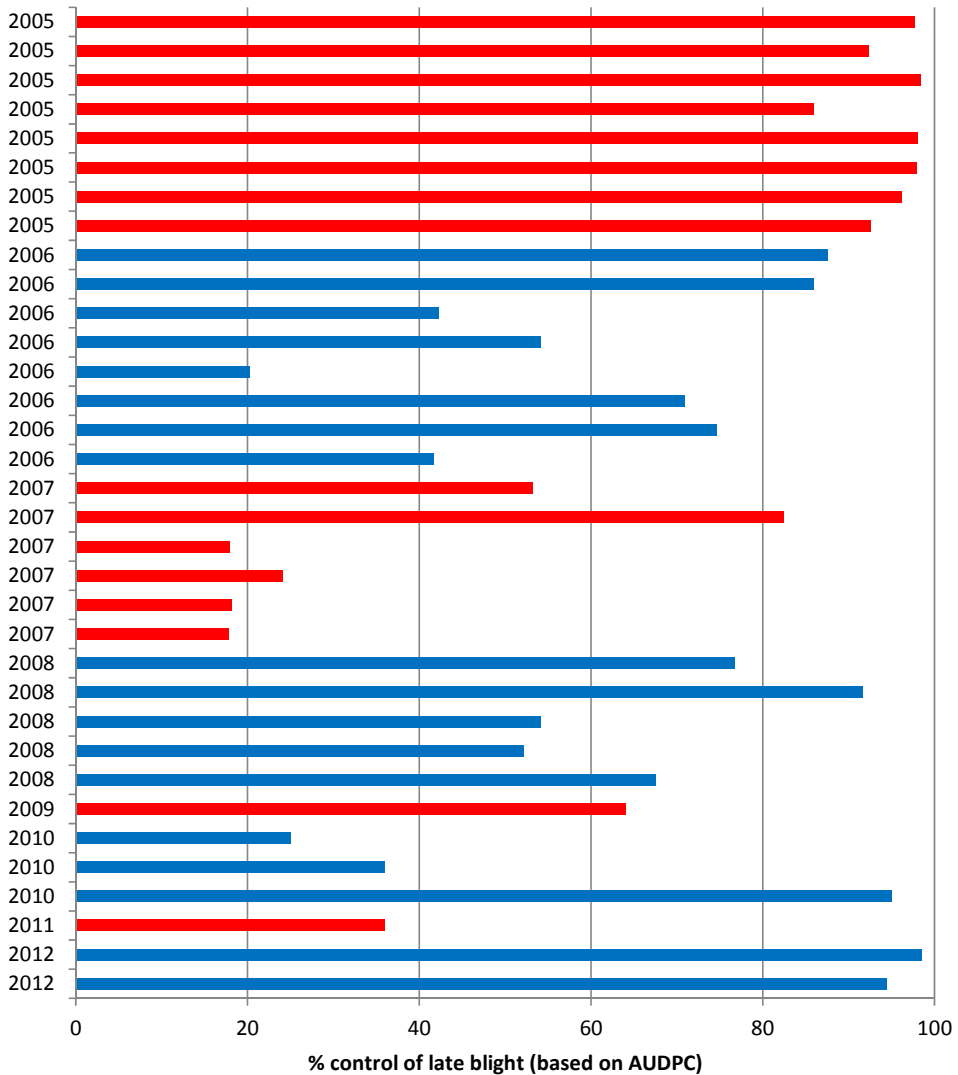
### **INTRODUCTION**

Shirlan (fluazinam) was introduced on the Danish potato market in 1998. Together with mancozeb, Shirlan was for many years the main product used for control of potato late blight (Cooke *et al.*, 2011). Spraying was recommended at weekly intervals with a label dose of 0.4 l/ha, and the effect against late blight was normally high, even under high disease pressure. In the same period the first DSS models were developed in which Shirlan was used with different dose levels depending on disease pressure (Nielsen, 2004). In 2006 field trials were carried out for the first time in which a significantly lower effect of Shirlan against late blight was observed. The same low effect was seen again in 2007, especially in field trials at Research Centre Flakkebjerg (Aarhus University).

### **FIELD TRIALS BEFORE 2006**

Results from field trials 2005 are shown in fig. 1. Spraying was performed at weekly intervals, 0.4 l/ha, 12 sprayings per season and with start before the first attack in the plots. Spreader rows between the blocks were inoculated with a mixture of isolates collected in 2003 from

Denmark. There was a severe disease development in the trials but spraying with Shirlan always resulted in a high efficacy level. The same picture was seen in other trials in Denmark, and the results shown in fig. 1 are more or less representative of the situation in trials before 2006.



**Figure 1.** Control of potato late blight (*P. infestans*) in Danish field trials 2004-2012. Spraying with Shirlan 0.4 l/ha at weekly intervals in susceptible starch varieties and artificial inoculations with mixed isolates. % control is based on calculations of AUDPC in the trials

### **FIELD TRIALS 2006-2007**

In 2006 a very low effect against late blight (20-54% control) was observed in four trials at Research Centre Flakkebjerg. Trial design, dose (0.4 l/ha), susceptible varieties, intervals, etc. were the same as in previous years, but the isolates used for artificial inoculation in early July were changed. A mixture of eight isolates collected from Flakkebjerg in the summer of 2005 was used as inoculum in the spreader rows. Variation in efficacy in spray trials with Shirlan had been seen before but never in so many trials at the same locality. Next year, 2007, the same low efficacy was seen again in five field trials at Research Centre Flakkebjerg (18-53% control, fig. 1). Same design, etc. as previously but in 2007 only four of the "2005" isolates were used as artificial inoculum in early July (these isolates were also used in 2006).

The low effect observed in 2006-2007 was mainly seen in field trials at Flakkebjerg Research Centre, but low-medium effect was also observed in other trials in Denmark in which disease pressure was high. Good disease control was observed at other locations in Denmark in which disease pressure was more moderate.

The significantly reduced effect observed at Flakkebjerg 2006-2007 was not reported from other countries. Previous trials at Flakkebjerg showed a variation in the effect against late blight but not as pronounced as seen in the trials 2006-2007.

### **LATER RESULTS**

Due to the low effect observed in the field trials recommendations for use of Shirlan in Denmark were changed, and the use of Shirlan in the potato production declined. Also, the number of trials with Shirlan at Flakkebjerg declined. New isolates collected in potato fields in Denmark in 2007 (Flakkebjerg and other localities) were used as artificial inoculum. The effect after spraying with Shirlan (0.4 l/ha, same set-up as previously but with new isolates) varied in the trials 2007-2011 (25-95% control), but generally the effect was higher than in 2006-2007 (fig. 1). In 2012 only one field trial was performed at Research Centre Flakkebjerg, and here the effect was very high (95-99% control). The same isolates were used for artificial inoculation as in 2008-2011 supplemented with two isolates from 2011.

### **TEST OF ISOLATES**

Some of the isolates from 2007 and later years were tested for sensitivity to fluazinam, and the results showed that the sensitivity was within the standard range (Syngenta, unpublished). Isolates from 2008-2012 were also tested for genotype, and no "green33" or "blue13" was found (Geert Kessel, Wageningen and David Cooke, Hutton Institute; unpublished results).

### **CHANGE IN USE AND RECOMMENDATIONS**

The recommendations for use of Shirlan in Denmark were changed from 2008. Shirlan (0.3-0.4 l/ha) is only recommended at low disease pressure and not in high-risk periods and periods with active new growth. Recommended spray interval is 7 days and only at low risk of infection up to 10 days. The use of Shirlan in Denmark drastically declined from 2008, and new products came on the market (Ranman and Revus) replacing Shirlan. The DSS models were also replaced with new products (Nielsen *et al.*, 2010) ensuring a high disease control.

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## CONCLUSIONS ON FIELD TRIALS WITH FLUAZINAM

- Stable and high effect against late blight before 2006
- Low-medium effect in many trials 2006-2007
- Mainly in inoculated trials at Research Centre Flakkebjerg
- Variation in effect 2008-2011 (low-moderate-high)
- High effect 2012 (one trial)
  
- Inoculated trials
  - New isolates (inoculum) 2006-2007
  - New isolates (different) again from 2008
  - No signs of reduced sensitivity (Syngenta test)
  - No "green32" or "blue13" genotypes observed
  
- Continuous and high disease pressure at Research Centre Flakkebjerg
- Problems observed in susceptible varieties with rapid growth at start of late blight epidemic
- Changes in recommendations: no use in high-risk periods and periods with active new growth

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