



Agriculture & Horticulture  
DEVELOPMENT BOARD



# Grower Summary

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## **FV 393**

Reducing bacterial infection in  
seed onions through the use of  
plant elicitors

Final 2012

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Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

## **Further information**

If you would like a copy of the full report, please email the HDC office ([hdc@hdc.ahdb.org.uk](mailto:hdc@hdc.ahdb.org.uk)), quoting your HDC number, alternatively contact the HDC at the address below.

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HDC is a division of the Agriculture and Horticulture Development Board.

**Project Number:** FV 393

**Project Title:** Reducing bacterial infection in seed onions through the use of plant elicitors

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**Contractor:** Mylnefield Research Services (The James Hutton Institute)

**Industry Representative:** Andy Richardson, Allium and Brassica Centre

**Report:** Final report

**Publication Date:** 13th April 2012

**Previous report/(s):** None

**Start Date:** 1st April 2011

**End Date:** 31st December 2011

**Project Cost (total project cost):** £57,497 (£61,497)

## Headline

Compounds that increase natural pathogen resistance mechanisms in plants have been shown to reduce infection of red onion bulbs by the bacterial pathogen *Burkholderia gladioli* pv. *Alliicola*

## Background

*Burkholderia gladioli* pv. *alliicola* (Bga) is a bacterial pathogen causing rot in onion bulbs. The disease is particularly economically damaging in red varieties, which are heat-treated over the previous winter to prevent bolting. In the UK and Europe, losses of up to 40% have been recorded in store due to bacterial infection. Bga is believed to be the principle cause of bacterial rot in onions and is prevalent in the soil but can also be found on plant roots and in water. Infected sets are thought to be a source of re-infection in maturing bulbs. Infection occurs following wounding to the leaves of growing plants and is exacerbated by wet climatic conditions.

Compounds that induce natural plant defense pathways (elicitors) have been reported to provide protection against a number of pathogens, in a range of crop species. In Asia, some are used as standard applications for rice. The compounds can be mimics of natural plant hormones, or are present elsewhere in nature and act by inducing a genetic response in the plant that results in increased protection against microbial pathogens. Although they are not currently widespread, there is a growing body of experimental work with them, which has shown that they tend to work better in combination, most likely because multiple defense pathways are triggered.

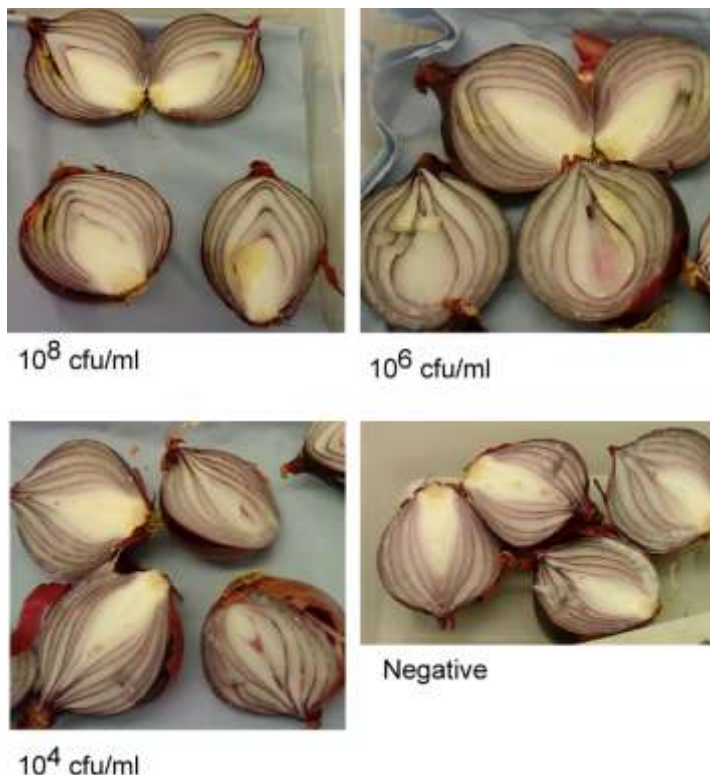
Plant defensive systems effectively work two tiers, the first (basal) tier provides a broad level of protection against a range of different microbes, while the second is triggered when some of those microbes are able to overcome basal defense. Elicitors work by triggering various arms of the basal resistance and therefore are most suited to microbes that are termed opportunistic, i.e. those that can only cause symptomatic disease under optimal conditions. Bga is a typical opportunistic pathogen only able to infect onions through fresh wounds in the leaves that occur, for example, after hail-storms. It is likely to be present on healthy, undamaged plants, but not at high enough concentrations or in the right location on the plant, to cause disease.

Current treatment options for Bga (and other opportunistic pathogenic bacteria on plants) are restricted to treatments or fungicides that actively kill the bacteria, e.g. Cuprokyt (copper oxychloride).

This project was established to test whether compounds that strengthen the plants own defence against a broad range of opportunistic plant pathogens can also prevent or reduce the level of disease in onions caused by Bga. Treatments were chosen on the basis of their reported activity against a number of different pathogens in horticultural and combinable crops.

### Summary of the project and main conclusions

Glasshouse trials were set-up to test elicitors on Bga infected onions between April and November 2011. The onions were infected with different levels of Bga (Figure 1). Onions (var. Red Baron) were grown from seed in compost, in individual pots and allowed to establish for 11 weeks before fungicides were applied.



**Figure 1.** Photographs of artificially infected mature red onion bulbs, at different concentrations of inoculum. The values refer to the inoculum concentration and the uninfected control (Negative).

Seven treatment variations were tested, incorporated into a standard fungicide programme (Table 1). The elicitors were incorporated into applications 1, 3, 5 on an 18 day period.

The bulbs were harvested one week after the final treatment then stored in paper bags in cold storage (1-4°C) for at least four weeks. The onions were then tested for disease levels.

**Table 1.** Treatment Programme

Application (Date)	Treatments				
	1 SFP	2 Amistar	3 Unicur	4 Unicur + Cuprokylt	5, 6, or 7 Elicitors
1 (30/05/11)	Invader	SFP + Amistar	SFP + Unicur	SFP + Unicur + Cuprokylt	SFP + elicitor AB, AD, CD
2 (08/06/11)	Valbon, Switch	SFP	SFP	SFP + Unicur + Cuprokylt	SFP
3 (17/06/11)	Invader	SFP + Amistar	SFP + Unicur	SFP + Unicur + Cuprokylt	SFP + elicitor AB, AD, CD
24/06/11	Apply bacteria	Apply bacteria	Apply bacteria	Apply bacteria	Apply bacteria
4 (26/06/11)	Fubol Gold, Switch	SFP	SFP	SFP	SFP
5 (05/07/11)	Invader	SFP + Amistar	SFP + Unicur	SFP + Unicur + Cuprokylt	SFP + elicitor AB, AD, CD
6 (14/07/11)	Valbon, Switch	SFP	SFP	SFP + Cuprokylt	SFP
7 (23/07/11)	Invader	SFP + Amistar	SFP + Unicur	SFP + Unicur	SFP + elicitor AB, AD, CD
8 (01/08/11)	Invader	SFP	SFP	SFP	SFP

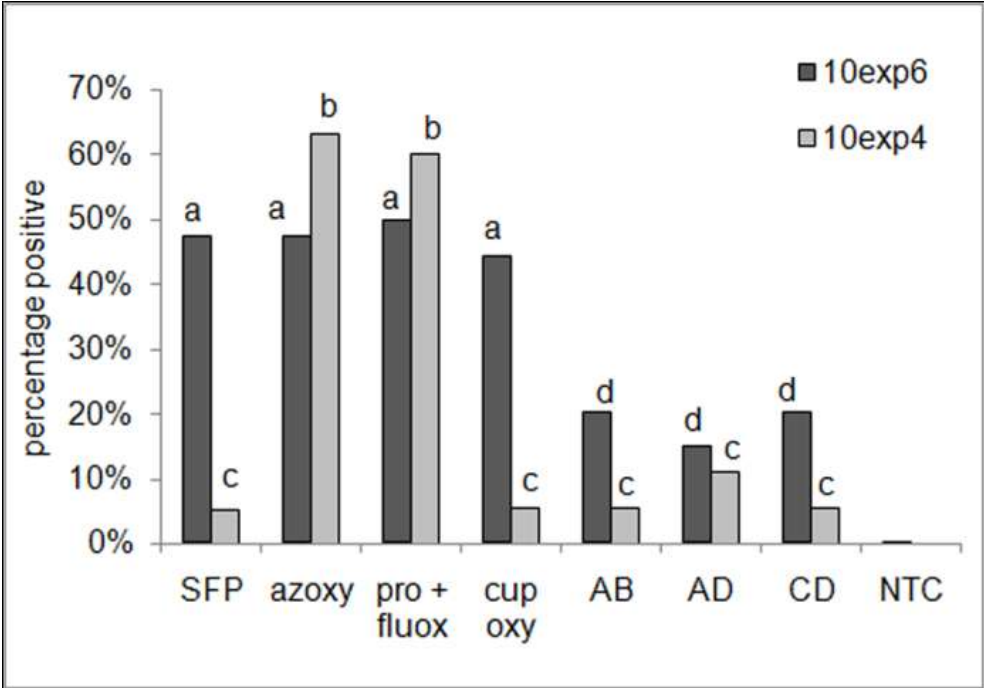
**SFP = Standard Fungicide Program.**

**Table 2.** Fungicides and elicitors used in the trial

Fungicide	Concentration	Label	Treatment Number
Amistar	1 L / Ha	azoxy	2
Unicur	1.25 L / Ha	pro+fluox	3, 4
Cuprokylt	2 kg / Ha	cup oxy	4
Invader	2 kg / Ha	n/a	SFP
Valbon	1.6 kg / Ha	n/a	SFP
Switch	1 kg / Ha	n/a	SFP
Fubol Gold	1.9 kg / Ha	n/a	SFP

Elicitor combinations	Concentration	Label	Treatment Number
BABA + Bion	1 mM + 1 mM	AB	5
BABA + Probenazole	1 mM + 0.2 mM	AD	6
cis-jasmone + Probenazole	3.2 mM + 0.2 mM	CD	7
No treatment control	n/a	NTC	8

The addition of plant defensive elicitors into a standard fungicide programme resulted in a significant and large reduction in the incidence (and extent) of infection of red onions by Bga that was greater than standard treatments, opening the way to possible use of these elicitors in commercial onion production.



**Figure 2** This bar chart shows the number of infected bulbs at two doses of bacterial inoculum. Dark grey is the higher dose and light grey is the lower dose.

*Higher dose* – columns marked D are significantly more effective in treating Bga than columns marked A.

*Lower dose* – columns marked C are significantly more effective in treating Bga than columns marked B.

Further work is now required to understand the underlying mechanisms of protection, which in turn, will provide information for a targeted use of the elicitors.

**Financial benefits**

At this point it is not possible to accurately cost the use of elicitors, since they are still experimental.

## **Action points for growers**

Incorporation of plant defense elicitors reduced the level and incidence of Bga infection in red onions. However, at this stage these compounds are experimental and not licensed for use in the UK.