Grower Summary

FV 392

Relationship between disease incidence in stored bulb onions and first year sets

Final 2012

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Project Number:	FV 392
Project Title:	Relationship between disease incidence in stored bulb onions and first year sets
Project Leader:	Dr S J Roberts (Plant Health Solutions Ltd) and Dr J P Clarkson (Warwick Crop Centre) (Joint Leaders)
Industry Representative:	R Oldershaw, Glebe Farm
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Previous report/(s):	None
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Project Cost	£53,348

Headline

This project is identifying the main causes of rots in stored onion bulbs grown from sets and investigates the where the infection could be coming from.

Background

There is a perception that the risk of certain onion diseases may be increased when crops are grown from sets. The major diseases of concern to the industry are: bacterial rots thought to be caused mainly by *Burkholderia gladioli* pv. *alliicola* (*Bga*; particularly in heat-treated red Rijnsburger type onions), neck rot caused primarily by *Botrytis allii* and Fusarium basal rot caused by *Fusarium oxysporum* fsp *cepae*. One possibility is that the necessary heat treatment of some cultivars may lead to increased risk of disease. This project represented a first step to address these issues by determining the incidence of the major bacterial and fungal onion pathogens thought to be associated with sets of different types and establish if there is a relationship between disease incidence in sets and subsequent problems in the harvested bulb onion crop. It is anticipated that, based on these initial results, a follow-on project will investigate way of reducing the impact of any disease problems associated with sets.

Summary

- The primary causes of rots in the stored bulbs grown from sets was the bacteria *Burkholderia gladioli* pv. *alliicola* (*Bga*) and the fungus *Fusarium oxysporum.* The neck rot pathogen, *Botrytis aclada*, was not detected.
- There was an indication that the primary source of *Bga* may be the sets and that heat treatment of sets may predispose them to or exacerbate infection/disease in the harvested bulbs.
- Bulk testing of sets for *Bga* may give an indication of the risk of disease in the harvested crop.
- The primary source of *Fusarium* in these trials appeared to be the field sites themselves, with a different Fusarium 'type' responsible for disease at each site.

Twelve samples of onion set lots with different expected disease levels were obtained from three suppliers just before planting time. These included nine red onion samples, and three browns. The samples were allocated random code letters, sub-samples were retained for laboratory testing/analysis, and the remainder planted at two field sites, one in Lincolnshire and one in Suffolk. Plots were 3 beds wide by 10 m long, and were surrounded by a commercial red onion set crop. At each site the trial plots received the same fertiliser, irrigation and spray program as the surrounding crop. Bulbs were topped and harvested at

the same time as the surrounding crops, then bulbs from both trial sites were cured and stored following standard practice at a single location.

Disease assessments and isolations from sets

Sub-samples of 200 sets from each lot were cut in half and examined for disease symptoms, and the incidence of different symptom types (bacterial, fungal, basal rots) recorded. None of the lots had clear symptoms of basal rot, although many had some degree of discolouration of the base plate. In most cases internal rots were not obviously bacterial or fungal, so assignment to internal bacterial or fungal was to some extent arbitrary, unless there was obvious fungal sporulation. Direct isolations of potential pathogens were attempted from the different symptom types. A range of bacteria, and fungi were obtained. The only pathogenic bacterium obtained by direct isolation from symptoms was *Bga* (from two lots). Although a number of different Fusarium 'types' were isolated, these were were not detected in the harvested bulbs and in preliminary tests were non-pathogenic or only very weakly pathogenic. The neck rot pathogen *Botrytis aclada* was not isolated.

In addition a 'bulk soak test' (irrespective of symptoms) for *Bga* was also done on a further 2 sub-samples of 200 bulbs from each lot. *Bga* was detected in three lots by this method.

Disease assessment and isolations from harvested bulbs

Table 1. Summary of symptoms, isolations and tests on the twelve set lots planted in the field trials.

Lot	General appearance	% Basal	% Shriv. + int. rots	% Bga (direct)[1]	% Bga (bulk)[2]	% Fusarium[3]
A	Shrivelled obvious, occasional sprouting	0.5	11.5	0	<0.8	100
B	Good, but many slightly soft	1.0	4.5	0	<0.8	0
C	Good, but most slightly soft	8.5	5.5	0	<0.8	59
D	Generally look okay	0.5	5.5	0	0.3	0
E	Generally okay, some soft, some surface mould.	2.0	2.0	0	<0.8	17
F	V. good, firm	5.5	4.0	0	>0.1	35
G	V. good, firm	6.0	3.0	0	<0.8	53
H	Damp, external mould growth on most, soft	8.0	9.0	0	<0.8	13
J	Generally good, several shrivelled.	2.0	9.5	22	<0.8	55
K	Generally. okay, some surface mould.	6.5	3.5	0	<0.8	6
L	V. good, v. firm.	0.0	10.0	11	>0.1	27
M	Good, firm. Difficult to decide about basal symptoms.	3.0	1.5	0	<0.8	14

Abbreviations: Shriv. - shrivelled, int- intenal

[1] The % of direct isolation attempts from up to nine bulbs with symptoms yielding *Burkholderia gladioli* pv. *alliicola (Bga)*.

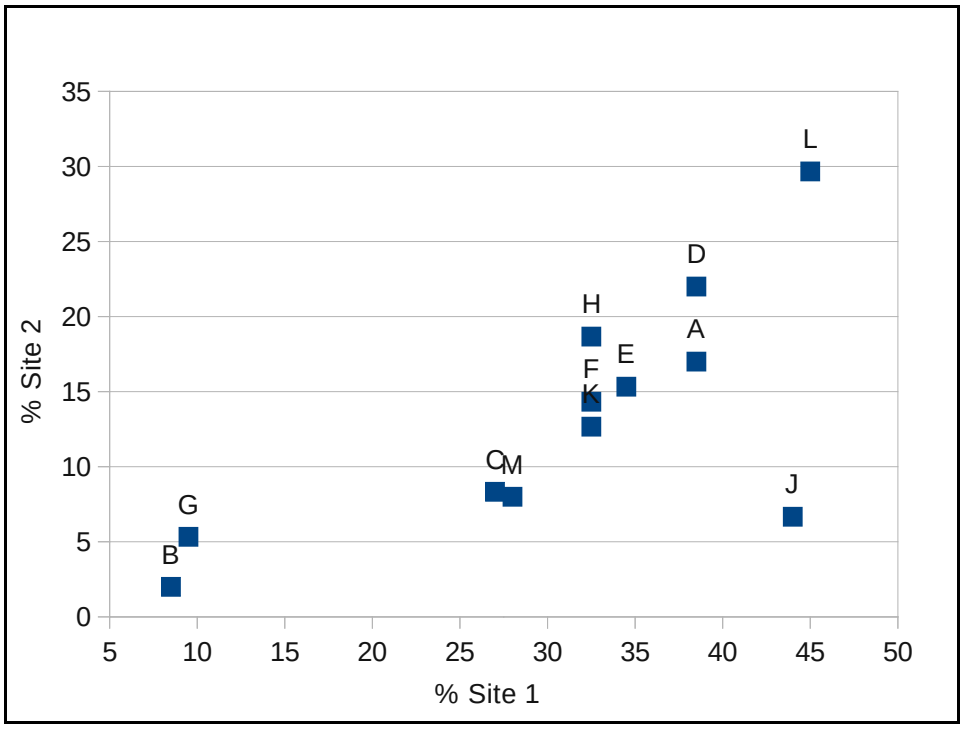

Figure 1. Percentage total rots in the bulbs harvested from the two trial sites.

Bacterial and 'neck rots'

Assessing bulbs with bacterial or neck rots was more difficult than basal rots. Except where bulbs were completely mushy/rotten, the two types of symptoms were easy to differentiate from bulbs with basal rots, but it was difficult to distinguish between them. The main criterion for discriminating between 'bacterial' and 'neck' rots was whether the rot was affecting a group of scales with the disease progressing down all scales at the same time (neck rot), or affecting individual scales (bacterial rot). However, it proved difficult to apply this criterion in many cases. In addition we consistently failed to isolate *Botrytis allii/aclada* (the neck rot pathogen) from any bulbs assigned to the 'neck rot' category, and *Bga* was isolated from close to the neck in some bulbs which could have been assigned to the neck rot category. We therefore consider that the majority of bulbs initially assigned to the neck rot category (mainly at site 1) were mis-diagnosed and were included in the bacterial rot category for the purposes of analysis.

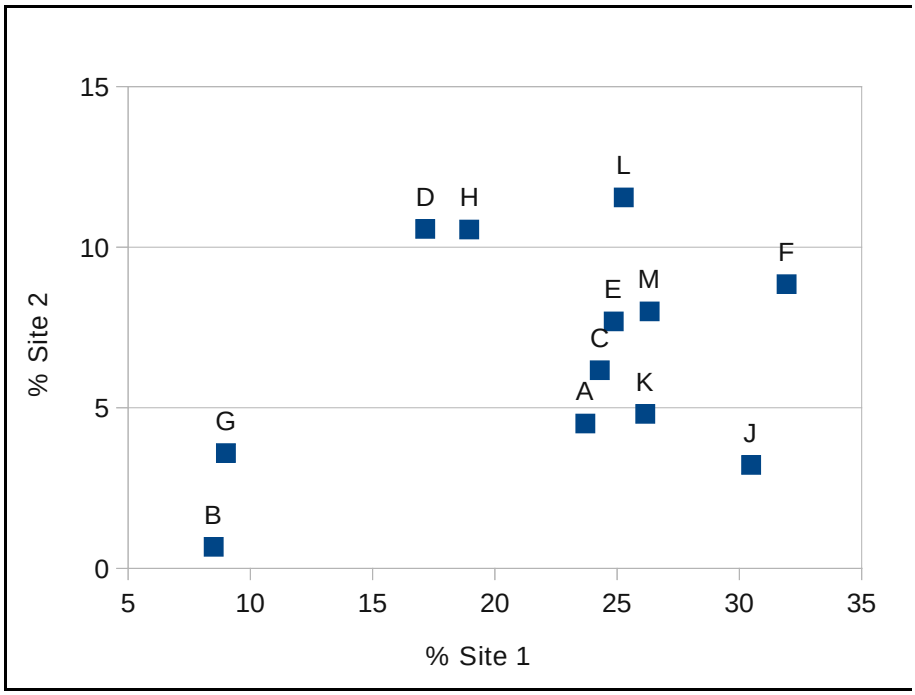

Figure 1: Percentage of bulbs with bacterial rots at each field trial site

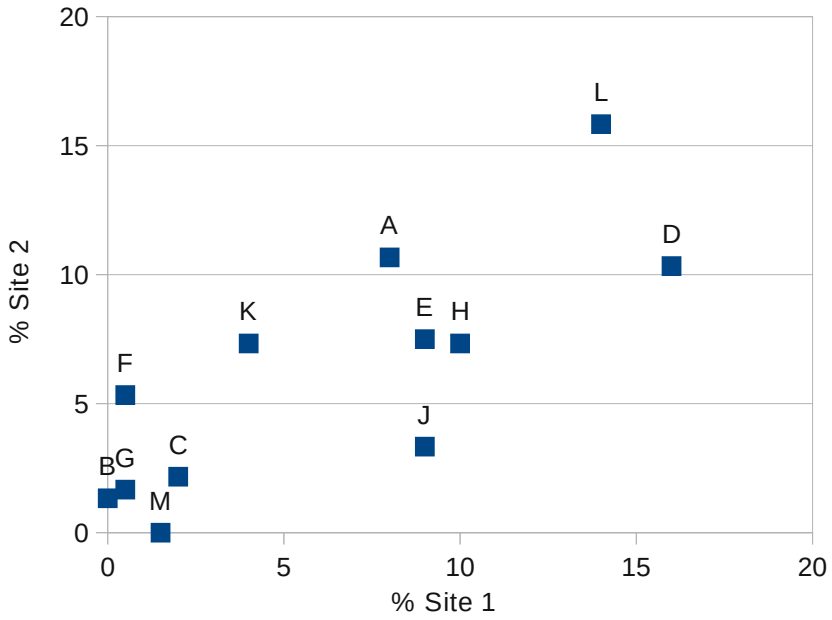

Figure 2. Percentage of bulbs with Fusarium basal rots at each field trial site

or type observed in the harvested bulbs: the two types isolated from bulbs were not detected in the sets; Lot D had some of the highest basal rot in the bulbs, but no *Fusarium* isolated from the sets; Lot C had the highest frequency of *Fusarium* in the sets, but the lowest basal rot level in the harvested bulbs. Hence it would appear that differing levels of *Fusarium* rots seen in the harvested bulbs are a result of differences in susceptibility amongst lots to the *Fusarium* inoculum present in the fields.

Conclusions

Given the limitations of this initial experiment and approaches, all conclusions should be considered with some caution and to be of a preliminary nature:

- The external visual appearance of sets was a poor indicator of health status or storage rots.
- *Burkholderia gladioli* pv. *alliicola* (*Bga*) was the main cause of bacterial and 'neck' rots and was the only bacterium isolated from both sets and bulbs that was consistently pathogenic.
- *Bga* was detected in some set lots and these lots had a tendency to give the highest levels of bacterial rots in the harvested bulbs.
- Bacterial storage rots may be under-reported due to confusion with Botrytis neck rot symptoms.
- There was an indication of a significant effect of heat treatment of sets on bacterial rots in storage.
- There was strong effect of site on the levels of bacterial rots – mainly associated with harvest date.
- A range of at least nine *Fusarium* 'types' was isolated from sets but there appeared to be no relationship between the levels or type isolated from sets and the levels of basal rots in bulbs.
- Basal rot in the stored bulbs was associated with two different *Fusarium* 'types' which appeared to be specific to each field site, and were not detected in the sets.
- There was no effect of site on the levels of Fusarium basal rot.
- The different set lots appear to differ in susceptibility to Fusarium basal rot.
- There was no evidence of an association between heat treatment of sets and Fusarium basal rot based on a limited data set.

Financial benefits

The UK onion area is around 9,000 ha producing 400,000 tonnes. Sets are grown on up to a third of the area. Up to 40% losses have been reported for bacterial storage rots, and based on an average yield of 40 t/ha this could amount to losses equivalent to 48,000 tonnes for set crops. It is clear that, in the conditions of the trials in the project that losses from rots may exceed the values previously reported (e.g. 45% identified in one lot in this study), and that losses may result from infection with either *Fusarium* or *Burkholderia.* This was a preliminary project intending to identify targets for further work, therefore there are no direct financial benefits at this stage.

Action points for growers

- Send samples for laboratory diagnosis to discriminate Botrytis neck rot and bacterial rot symptoms.
- Consider having sets bulk tested for the presence of Bga before planting.