Grower Summary

FV 378

Assessment of plant elicitors to induce resistance against head-rot in broccoli

Annual Report 2011

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Further information

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

HDC
Stoneleigh Park
Kenilworth
Warwickshire
CV8 2TL

Tel – 0247 669 2051

Headline

- On-going trials aim to determine whether head-rot in broccoli (calabrese) caused by opportunistic soil bacteria, can be controlled through the use of 'elicitors' to induce the plants own defence response.

Background

Head-rot in broccoli is a major cause of crop loss in the UK and abroad. It is caused by bacteria in the soil that are able to infect the plants under 'ideal' conditions, in particular high humidity. The bacteria are present in high numbers in soil and are ubiquitous, and because they will only infect plants under the most appropriate conditions, they are termed opportunistic pathogens. Current treatments rely on copper oxychloride (e.g. Cuprokylt), which act as a disinfectant on the plant. However, because the source of the bacteria is effectively limitless and the chemicals can be damaging to the plants and to the environment, finding suitable alternative treatments is a high priority. Plant defence elicitors do not have anti-microbial activity against fungi, bacteria or other pathogens, but instead they trigger a defensive reaction in the plant, making the plants more resistant to infection. Application of elicitors can be incorporated into a normal fungicide regime. Together these aspects make them an excellent candidate for treatment against head-rot in broccoli.

Summary of the project and main conclusions

A two-year project (2010 – 2012) was undertaken to assess whether elicitors can be used to protect broccoli against bacterial head-rot. Some of the elicitors have been used successfully against bacterial pathogens on other crops, for example Probenazole (Oryzmate) is a standard treatment against rice blast in Asia. Others have shown promise in experimental greenhouse trials, including BABA and Bion against head-rot in broccoli. Elicitors are potentially a good alternative to disinfectants for diseases such as head-rot where the bacteria that cause the disease are opportunistic pathogens, ubiquitous and present in high levels in the soil.

Methods

In year 1, broccoli transplants (vars. Marathon, Parthenon) were planted in mid April and mid July 2010 in replicated experimental sites (SCRI, Invergowrie and SAC, Pitlochie) for trials 1 & 2 respectively. In addition, a commercial site (Wormitt) was used to test licensed fungicides, where the transplants were planted in July 2010, for trial 3. The trial sites were

approximately 100 m x 80 m, made up of six beds of treated plants, each bordered by 'guard' beds containing un-treated plants. In each treatment plot 20 plants were assessed for trials 1 and 2, and 60 plants assessed for trial 3. Each treatment plot was replicated three times. Assessment was carried out approximately 9 weeks after planting.

A group of five elicitors (BABA, Bion, *cis*-jasmone, Probenazole, Yea foliar) and three licensed fungicides with known or expected elicitor activity (Amistar, Justice, Flyer) were selected for the trial. Cuprokylt was included as a positive control in the commercial trial and all trials included a negative, untreated control. The elicitors were used either singly or in combination, with the aim of triggering multiple defensive pathways in the plant. Elicitors were applied three times in 10-day intervals; the first application was approximately one week before head initiation. A cocktail of head-rot bacteria was applied twice with a one-week interval and the first application was between the first and second elicitor application.

Laboratory experiments were carried out to determine the relative contribution of disease from three different head-rot bacteria species. The presence of head-rot bacteria on trial plants was detected using laboratory tests.

Results

Trials 1 & 2: Half the plants infected with head rot bacteria

- Trial 1 (April 2010): No significant effect on presence of head-rot symptoms was found with any of the treatments. However, plants that had been treated with bacteria were significantly more diseased than the untreated plants (this difference was only apparent at the SCRI site). Combinations containing Probenazole and Amistar appeared to provide some protection, while the combination of BABA and Bion resulted in the highest level of disease. The main issue from trial 1 was a lack of head-rot symptoms which made any statistical differentiation between the treatments difficult. Possible reasons for the lack of disease were particularly dry weather in June 2010 and low levels of nitrogen.

- Trial 2 (July 2010): Lack of disease symptoms meant that it was not possible to statistically distinguish any differences between the treatments (from both experimental sites). The relative lack of disease occurred despite increasing the concentration of added bacteria 100-fold. As in trial 1, the combination of BABA and Bion resulted in the highest number of diseased plants.

Trial 3: Plants not artificially infected with head rot bacteria

- Trial 3 (July 2010): The majority of treatments gave similar protection to Cuprokylt, with no significant differences between them. However, plots treated with Flyer had significantly greater numbers of diseased plants. Furthermore, the extent (spread) of head-rot symptoms was greater across the plants. This may be due to the changes in the total microbial population on the plants in the presence of the fungicide, which could in turn provide conditions that were more conducive for head-rot bacteria.

Laboratory analysis showed that one bacteria species, *Pseudomonas fluorescens*, was responsible for the greatest extent of disease in comparison to *Ps. marginalis* and *Pectobacterium carotovora*, although all three species were capable of causing typical head-rot symptoms on broccoli heads. It is of note that it was possible to detect head-rot bacteria from diseased and healthy plants in trial 3, the commercial site, where bacteria were not artificially added.

Main conclusions

- Head-rot bacteria are common and can be isolated from healthy plants.
- Disease occurred in the absence of artificially added bacteria.
- Greater levels of disease are required to differentiate between the treatments.
- Application of Flyer significantly increased the number of diseased plants.

Plans for Year 2

The transplants will be planted in late April 2011 and early July 2011 so that the trials are more likely to coincide with the climatic conditions that will induce head-rot. Irrigation will be applied to the trial and the level of nitrogen fertiliser increased. Although disease can occur in the absence of additional bacteria, we will add the same level of bacteria as in trial 1 to keep the conditions similar.

Financial benefits

At this point it is not possible to draw any conclusions about financial benefits as the trial is on-going.

Action points for growers

At this point it is not possible to recommend any action points as the trial is on-going.