Spear rot on calabrese

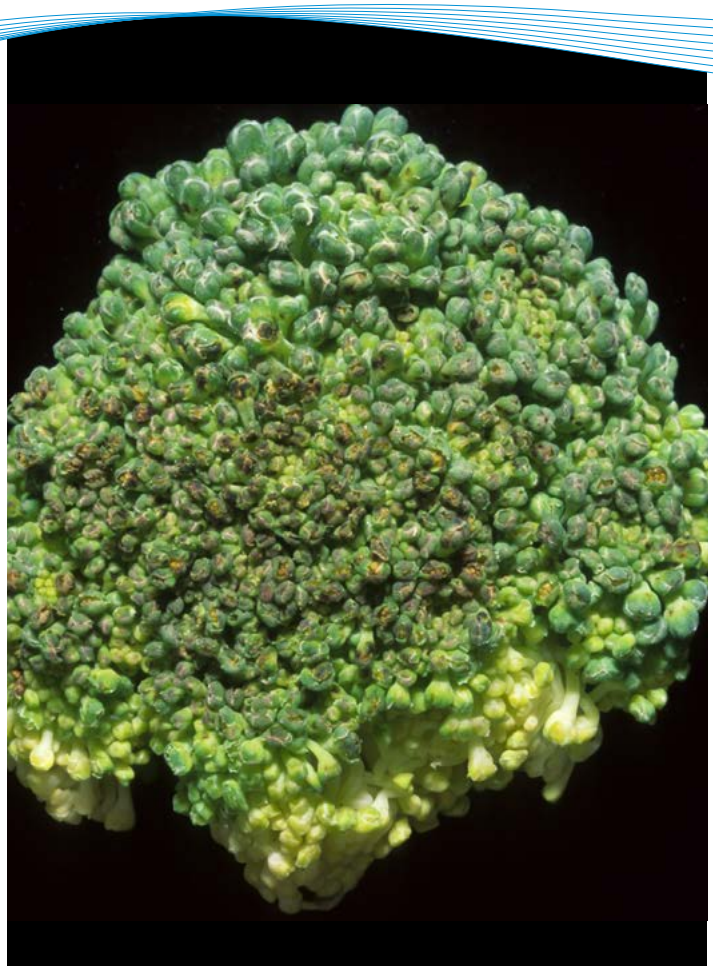

Figure 1. Initial dark water-soaked lesions on individual florets

Figure 2. Progressive rot of whole head

Action points

- **Select varieties with reduced susceptibility, particularly for late-season/autumn production**
- **Do not apply excessive nitrogen**
- **Consider minimising overhead irrigation, particularly reducing the frequency**
- **Avoid growing late crops in high-risk fields**

Spear rot (or head rot) of calabrese and broccoli can be a major cause of losses in the UK. Estimates of losses vary, but the most recent suggest average losses of around £3.7 million per annum.

Symptoms

Spear rot first becomes apparent as water-soaked blackening of individual florets (buds) (Figure 1). The lesions expand to produce larger blackened areas and a progressive soft rot of the whole head (Figures 2 and 3, overleaf). Affected heads are completely unmarketable. Disease symptoms usually become apparent in the field as the crop approaches maturity or may develop after cutting.

The pathogen and biology

There has previously been some confusion about the cause of the disease: it is primarily caused by particular pectinase- and biosurfactant-producing strains of the bacterium *Pseudomonas fluorescens* (synonymous with *Pseudomonas marginalis*) belonging to LOPAT group IV. Pectinases are enzymes responsible for the soft rot of the tissues, and the biosurfactants are wetting agents that enable the bacteria to get into the floret tissues. This was conclusively demonstrated during work at Wellesbourne in the late 1990s and also confirmed by scientists in Canada.

Figure 3. Cross-section of an affected calabrese head

Another pectinase-producing bacterium, *Pectobacterium carotovorum* subsp. *carotovorum* (formally *Erwinia carotovora*), is often isolated and has sometimes been described as the primary cause, but it is more likely that *Pectobacterium* is a secondary invader of rots already initiated by *Ps. fluorescens* or other pathogens such as downy mildew or Botrytis, or following physical damage from hail or frost, etc. Two key factors have contributed to the confusion: the addition of wetters in inoculation experiments and the inoculation of, or production of, plant material for inoculation in protected environments.

Further difficulties in understanding of the disease arise due to the uncertainties with the taxonomy/ nomenclature of pathogenic *Pseudomonas* strains. The 'species' *Ps. fluorescens* is actually a 'species complex' containing a number of quite different subtypes, many of which are non-pathogenic, and may arguably be considered as distinct species.

Epidemiology

Pathogenic *Ps. fluorescens* strains have been found on commercial seed lots. It has also been shown that they can be seed transmitted and then survive epiphytically (on leaf surfaces in the absence of symptoms) until heading.

Although the bacterium is often reported as soil-borne and 'ubiquitous', this has not been proven for pathogenic strains. Whilst fluorescent pseudomonads, including *Pseudomonas fluorescens*, can be frequently isolated from the environment (including the soil), there is no direct evidence linking specific strains originating from soil with spear rot.

Thus, at the current time, the relative importance of seed and transplants as sources versus other potential sources of the pathogen is not clear.

Spread in the field most likely occurs via water or rain splash, and the disease is encouraged by overhead irrigation and soft growth. It seems to be particularly associated with periods of prolonged wet weather and so is more prevalent in late-maturing crops.

Control

Cultural control

AHDB Horticulture projects FV 104 and FV 104b showed that mulching reduced the levels of spear rot. This approach was based on the idea that the primary pathogen is ubiquitous in the soil, but this may not be the case, and it has not been taken up commercially.

High levels of nitrogen have been shown to increase levels of spear rot, but this effect may be variety dependent. Thus it is important that growers do not apply excessive nitrogen.

A study in the US indicated that irrigation frequency, but not the amount of water applied, nor the timing, had an effect on the amount of bacterial head rot. Although these trials used *Pectobacterium carotovorum* as inoculum, it is possible that the same applies to *Pseudomonas*.

As the disease is associated with periods of prolonged wetness, it makes sense to select growing sites for later crops that are less sheltered, and away from coastal areas that are prone to fog.

Hygiene

Given the potential for seed transmission and spread in transplants, good hygiene during plant-raising could play a role in disease management.

Resistance

A number of studies have demonstrated differences in susceptibility amongst cultivars. For example, the variety Marathon (and likely its genetic derivatives) has significant levels of resistance, and it is likely that the popularity of varieties for late production is to some extent an indication that they are less susceptible.

As well as tissue resistance, a number of phenotypic/agronomic traits may also have an effect on susceptibility, e.g. domed heads, tightness of buds.

It is important to be aware that tests done on heads from plants raised under protection can give spurious results (more susceptible), due to the effects of the growing conditions on surface wax.

Figure 4. A good wax coating on the head that encourages beading of water droplets reduces susceptibility to spear rot

Acknowledgements

This is a revised version of an earlier factsheet prepared by P. Gladders and R. Kennedy.

Further reading

AHDB Reports

Robertson, S. & Brokenshire T. (1992) Calabrese: Control of spear rot and downy mildew. Final Report FV 008.

Taylor, J.D. (1994) Serological detection of spear rot of calabrese. Final Report FV 104a.

Campbell, L.J., Harling, R. Chard, J. & Sutton, M. (1995) Calabrese: Factors controlling symptom development in bacterial spear rot. Final Report FV 104.

Harling, R. & Sutton, M. (2001) Calabrese: Toward an Integrated approach to controlling bacterial spear rot. Final Report FV104b.

Holden, N.J., Toth, I., Newton, A., Walters, D. & McNicoll, J. (2012) Assessment of plant elicitors to induce resistance against head-rot in broccoli. Final report FV 378.

Holden, N.J., Newton, A., Walters, D. & McGrann, G. (2016) Use of plant defence elicitors to provide induced resistance protection in Brassica and Allium crops. Final Report FV 417.

Roberts SJ & Elphinstone JG (2017) Review of bacterial pathogens of economic importance to UK crops. Final report CP 174.

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