Grower Summary

SF 98

Sustainable management of *Mucor* and *Rhizopus* in strawberry

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Only officially approved pesticides may be used in the UK. Approvals are normally granted only in relation to individual products and for specified uses. It is an offence to use non-approved products or to use approved products in a manner that does not comply with the statutory conditions of use, except where the crop or situation is the subject of an off-label extension of use.

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), quoting your HDC number, alternatively contact the HDC at the address below.

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Headline

- Lab based tests have identified chemical control agents which inhibit mycelial growth of *Mucor* and *Rhizopus* spp. in vitro.

Background and expected deliverables

Mucor and *Rhizopus* both cause soft rots in raspberries and strawberries and losses can be significant when conditions are favourable resulting in rapid spread of the fungi in harvested fruit. They are primarily post-harvest rots but also occur on ripe fruit in the field. Both fungi cause similar symptoms on fruit. Infected fruit are initially slightly discoloured, gradually turning pale brown. The tissue rapidly softens and collapses and, under humid conditions, the fruit is soon covered with a dense, fluffy white mycelium which bears stiff, black-headed sporangia (pin mould).

Both fungi survive in soil and crop debris between seasons and produce thick walled resting bodies (zygospores) which serve as long-term resting spores. Some circumstantial evidence suggests that the rots may be encouraged by green manures.
Mucor and *Rhizopus* are both wound pathogens and are favoured by wet, moderately warm conditions (around 18^{o}C). The black spores are easily spread by wind, rain and pickers' hands. *Rhizopus* is inhibited by temperatures below 6^{o}C. However *Mucor* can grow and infect fruit as well at 0^{o}C as it can at higher temperatures. Essentially this means that *Rhizopus* can be controlled in soft fruit by cool chain management whereas *Mucor* will continue to develop during cold storage and marketing.

Neither fungus is well controlled by fungicides and there is evidence that the occurrence of these rots may be increased by the use of certain fungicides such as Rovral (iprodione) to control *Botrytis* rot. Control of these soft rots currently relies on cultural measures including the removal of all ripe fruit at harvest.

In developing improved methods of managing these rots to minimise losses, it is important first to establish the relative incidence of *Rhizopus* and *Mucor* in soft fruit crops.

Although fungicides appear to be relatively ineffective against these fungi, there may be alternative chemicals, such as those used in the food industry, that suppress *Mucor* or *Rhizopus* and could be used near to harvest.

This two year project aims to identify the relative incidence of *Mucor* and *Rhizopus* in soft fruit plantations. This will enable management systems to be developed which minimise losses. In addition laboratory studies will identify potential alternative chemicals offering activity against these rots.

Summary of the project and main conclusions

131 samples of soft rotted berries were received from fruit farms in England and Scotland. *Mucor* spp. was more frequently isolated from strawberry and raspberry soft rots than *Rhizopus*. 74% of isolates from strawberry and 88% from raspberry were identified as *Mucor* spp.

All except 6 samples (open field Elsanta) were obtained from tunnel covered crops, whether raspberry or strawberry. All isolates from the open field crop were *Mucor* spp. From this data it is not possible to draw any definitive conclusions on the effect of tunnels on the incidence of *Mucor* and *Rhizopus*. Very little information on management practices was collected from the growers that provided the rot samples, so it was not possible to investigate the relation between practice and rot incidence. This aspect of the project will be targeted in more detail in year two.

The efficacy of a range of chemicals against *Mucor* and *Rhizopus* was tested in the laboratory using potato dextrose agar (PDA) amended with the chemical under test at concentrations of 0, 1, 10, 100, 1000, 5000 ppm. Growth of mycelial plugs of the test fungus was measured after 1 or 2 days. Standard isolates of *Mucor piriformis, Mucor mucedo* and *Rhizopus stolonifera* were used as well as isolates of *Mucor* and *Rhizopus* obtained during the survey. Initial tests were conducted using Switch (cyprodonil + fludioxonil), Signum (pyraclostrobin + boscalid), potassium bicarbonate and potassium sorbate. All of the chemicals tested reduced or inhibited mycelial growth at the higher concentrations (1000, 5000 ppm). Switch and Signum also inhibited growth at lower concentrations. Switch was the most effective of the chemicals tested in inhibiting mycelial growth with most of the isolates failing to grow even on the lowest concentrations. Both potassium bicarbonate and potassium sorbate inhibited growth of the isolates at the highest concentration of 5000 ppm. In the second year of the project, further tests will be conducted using a range of fungicides and alternative chemicals including biocontrol agents..

Financial benefits

Soft rots caused by *Mucor* and *Rhizopus* are currently managed by cultural methods only or not at all, and are often overlooked as problems. The incidence of these rots has recently increased, particularly during the last two seasons when the weather has been particularly wet and favourable for spread, especially after harvest during marketing, when rot spread in punnets can be particularly unacceptable to the retailers. Once the disease is present in harvested fruit, spread can be very rapid, especially of *Mucor,* which continues to grow at the temperatures used in cold storage and cool chain marketing.

For developing strategies to control these rots it is important to know the relative incidence of *Mucor* and *Rhizopus* in soft fruit crops. If *Mucor* were the predominant species then additional control measures would need to be considered pre-harvest to control the problem. Such measures would not be needed for *Rhizopus,* which would be suppressed by the temperatures used in cool chain marketing.

This project will establish the relative incidence of the two rots in soft fruit plantations, identify practices that may increase the risk of these pathogens and identify chemicals or biocontrol agents that could be used to control the problem. From the information generated a sustainable management system will be developed, leading to a reduction in the incidence of *Mucor* and *Rhizopus* and a corresponding increase in marketable yields and returns.

Action points for growers

- The project is at an early stage and there are no action points to report at present.