Cold plasma to manage postharvest fungal pathogens of strawberries

An innovative PhD project from Murdoch University investigating the use of cold plasma technology to manage postharvest diseases in strawberries.

Agricultural Produce Commission (APC P1922 126) - Murdoch University Postgraduate Research Scholarship

Strawberries are very susceptible to microbial damage. Nearly half of all strawberries produced are lost between harvesting and consumption, with 30% of these losses attributed to fungal pathogens (Petrasch et al., 2019). In Australia, four fungi, *Botrytis cinerea* (grey mould), *Phytophthora cactorum* (leather rot), *Podosphaera macularis* (powdery mildew) and *Rhizopus stolonifer* (Rhizopus rot or 'leak') have been reported as postharvest pathogens of strawberries (Ullio, 2009; Anonymous, 2018). Among these, *B. cinerea* is associated with severe damage, and control of this pathogen is extremely difficult.

At Murdoch University, a PhD project is testing an alternative method to manage *B. cinerea* and other postharvest pathogens, using cold plasma. Cold plasma is an ionised gas that has antimicrobial properties, and has been demonstrated to control bacteria, viruses and fungal pathogens of fruits and vegetables, and extend shelf life (Siddique et al. 2018; Pan et al. 2019). For example, in the laboratory at Murdoch, we have shown we can reduce anthracnose in avocado and consequently double the shelf life. We have also conducted trials on blueberries, raspberries, truffles and cereal grain, with very promising results.

In the first stage of the strawberry project, we have isolated and identified fungi from strawberries exhibiting signs and symptoms of disease. These have included *Mucor* spp., *Rhizopus* spp., *Cladosporium* spp., and *Alternaria* spp. (Figure 1 and Figure 2).

Our aim is to conduct isolations throughout the coming strawberry growing season, investigating the variation in the pathogen population over time. We also hope to determine if there is variation in pathogens found on field grown vs hydroponically grown fruit. Commonly occurring fungi will be selected for DNA sequencing to confirm their identities.

Figure 1. Postharvest strawberries infected by fungal pathogens.

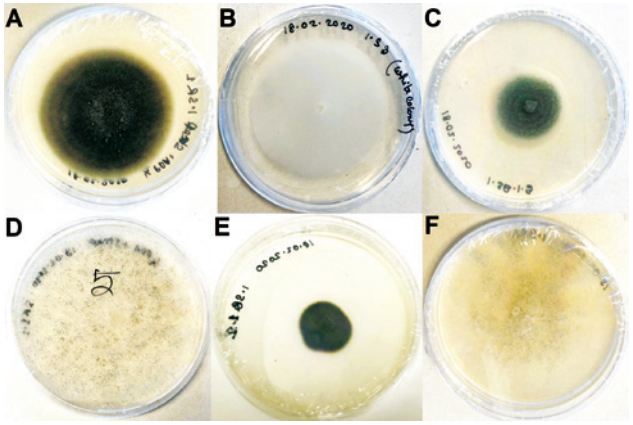

Figure 2: Cultures of different postharvest strawberry pathogens (fungi). Pathogens include A) *Alternaria* spp., B) *Geotrichum* spp., C) *Penicillium* spp., D) *Rhizopus* spp., E) *Cladosporium* spp., F) *Mucor* spp

To control the commonly occurring fungi, we will test both cold plasma and plasma activated water (PAW) as treatments for harvested fruit. PAW is created by treating water with cold plasma, generating a liquid that can be used to mist or wash fruit. At present, we are optimising plasma treatment conditions in preparation for a comparative trial once the new season strawberry harvest commences.

The comparative trial will include assessment of the antimicrobial ability of the two plasma treatments, based on the growth or inhibition of postharvest fungi on the treated fruit. We will also assess quality parameters of the fruit including colour, size and weight and shelf life.

The overarching aim of this study is to confirm cold plasma as an effective treatment for the control of postharvest pathogens of strawberries. We are also planning further work on other berries, and larger-scale commercial application trials. For further information, please contact Dr Kirsty Bayliss, K.Bayliss@murdoch.edu.au

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