

Combination treatment reduces charcoal rot and increases fruit yields of strawberry

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National Charcoal Rot Project

Macrophomina phaseolina is a soil-borne fungus that causes charcoal rot of strawberry and kills plants (Figure 1).

Charcoal rot remains the most widespread (occurring in all states) and devastating disease in the strawberry fruit industry in Australia and has increased in importance since the phase-out of the soil fumigant methyl bromide.

For the last three years, scientists from the Department of Agriculture and Fisheries (DAF) and the Victorian Strawberry Industry Certification Authority (VSICA) have conducted a national research project (BS15005 Improved Management of Charcoal Rot of Strawberry) to identify better ways of managing charcoal rot.

One of the key findings from the research is that crop termination with metham sodium followed by soil fumigation can increase fruit yields in the following crop by 26% and profits by \$0.96 per plant, compared with fumigation alone (Figure 1).

Crop Termination

Crop termination is the practice of killing old strawberry plants (Figure 2) and turning them into soil, before preparing beds and planting a new crop.

Traditionally, growers have used herbicides for crop termination, but this practice does not kill *M. phaseolina* in the crowns of old plants and in some circumstances may increase it. Any of the fungus surviving in old, buried crowns is difficult to kill with current fumigants, because they do not penetrate woody tissue.

Strawberry growers in California have had success with the use of metham sodium for crop termination. Metham sodium is a fumigant with strong herbicidal properties that growers can apply through the trickle irrigation system. The advantage of crop termination with metham sodium is that it can kill some of the *M. phaseolina* in the old plants and/or soil. It may also scarify the surface of the old crowns and make them more conducive to treatment with soil fumigants (e.g. Tri-Form® 80, EDN Fumigas™, Chloropicrin).

Field Trials in Australia

In collaboration with R&R Fumigation, Statewide Fumigation, and TriCal (California), we conducted extensive trials in Victoria to establish the application rate of metham sodium needed to kill old strawberry plants. This rate (200 L/ha) proved considerably higher than those used in California (100 L/ha), due to the heavier soil types in Australia.

We then conducted a field trial on a strawberry farm at Silvan, Victoria to determine if crop termination with metham sodium followed by fumigation with Tri-Form® 80 (80% chloropicrin: 20% 1,3-dichloropropene) would reduce disease and increase yields in the following crop.

The old strawberry crop was terminated in February 2018 with metham sodium (200 L/ha). The block was then fumigated with Tri-Form® 80 (400 kg/ha) in January 2019 and planted (cv. Albion) in February 2019.

The treatments in the trial included: (1) crop termination with metham sodium and soil fumigation with Tri-Form® 80 and (2) soil fumigation with Tri-Form® 80 alone (previous crop turned into the soil).

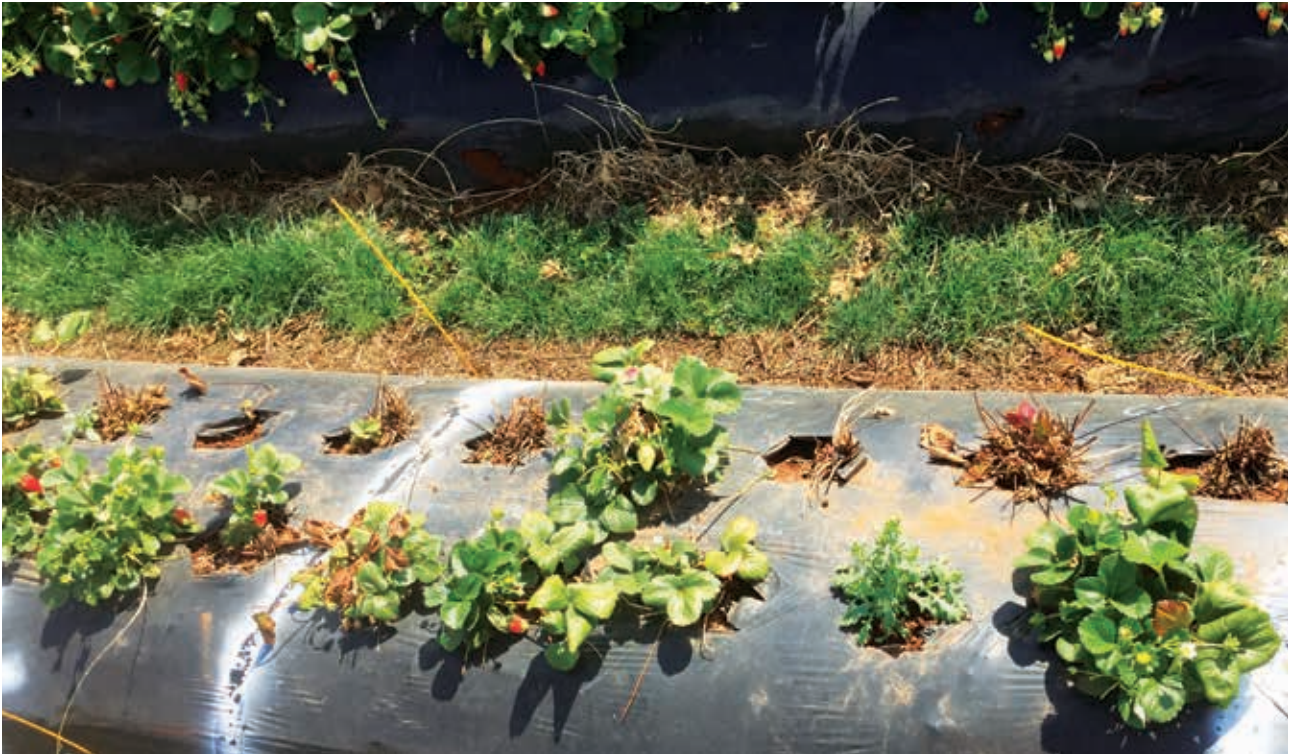


Figure 1. Plant death caused by charcoal rot of strawberry in a field trial at Silvan, Victoria. Photo credit: VSICA



Figure 2. Plant death caused by crop termination on a farm at Wandin, Victoria. Photo credit: VSICA

Results and Discussion

Crop termination with metham sodium followed by soil fumigation with Tri-Form® 80 increased fruit yields by 26% in the subsequent crop compared with Tri-Form® 80 alone (Figure 3). The incidence of charcoal rot in the crop was low in all treatments. However, crop termination with metham sodium + Tri-Form® 80 had less disease than Tri-Form® 80 alone. Partial-budget analysis showed that crop termination with metham sodium followed by fumigation with Tri-Form® 80 increased the revenue generated per plant by \$0.96 compared with Tri-Form® 80 alone (Figure 4).

Conclusions

Crop termination with metham sodium, followed by treatment with Tri-Form 80®, significantly increased fruit yields and the revenue generated by strawberry fruit, compared with Tri-Form 80® alone. There are several other methods of crop termination that have the potential to kill *M. phaseolina* in old strawberry crops, including microwave and biofumigant emulsions applied through trickle irrigation. These methods require further research, along with other non-fumigant

controls for charcoal rot and the evaluation of better diagnostic tests to support the selection and use of the most cost-effective treatments by growers. Phase 1 of the national charcoal rot project is concluding in October this year. Given the widespread distribution and economic importance of charcoal rot in Australia, the strawberry industry needs to carefully consider additional funding support and research to further improve the management of this disease. If you would like to learn more about the project activities, contact Dr Dylan McFarlane (0408 374 233) or your local member of the project team.

Acknowledgements

The project is funded by Hort Innovation using the research and development strawberry levy, and funds from the Australian Government. The Queensland Government, through the Department of Primary Industries (DAF), and the Victorian Strawberry Industry Certification Authority Inc. have co-funded the research. We also acknowledge the strawberry fruit growers who provided the field sites for the experimental trials.

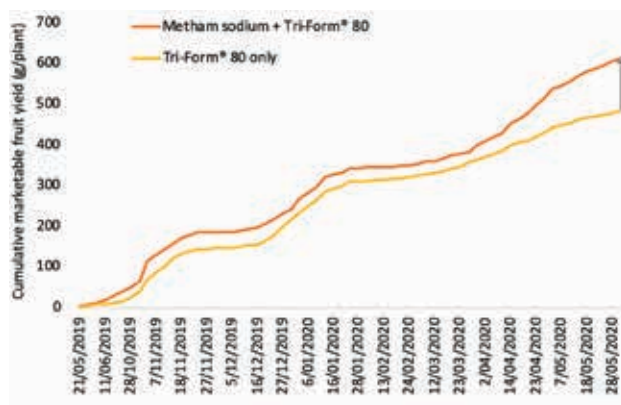


Figure 3. The cumulative marketable fruit weight per strawberry plant in a field trial at Silvan, Victoria. The bars represent the least significant difference ($p = 0.05$).

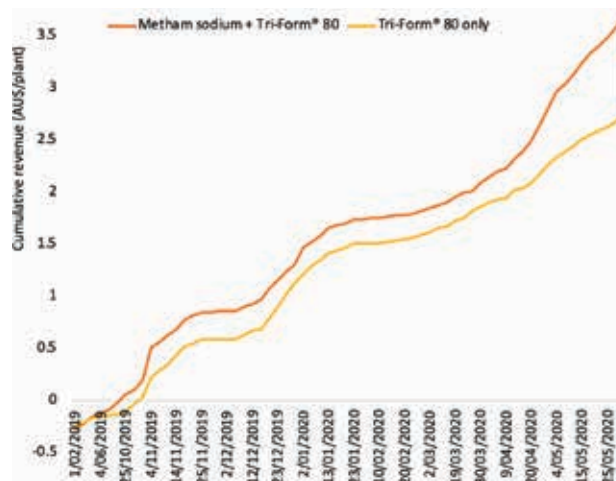


Figure 4. The cumulative revenue/ strawberry plant in a field trial at Silvan, Victoria. The bars represent the least significant difference ($p = 0.05$). The fumigation costs of the metham sodium and Tri-Form® 80 treatments were deducted from the revenue generated in those plots.

