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IMPROVED KNOWLEDGE OF FACTORS CONTRIBUTING TO CARROT ROT – VG15066

ON-FARM POWER GENERATION – OPTIONS FOR VEGETABLE GROWERS – VG13051

VG15066 – Improved knowledge of factors contributing to carrot rot

Facilitators

Project VG15066 was undertaken by Peracto Pty Ltd.

Introduction

Carrot crown rot has been identified as a major constraint to carrot production in Tasmania. The economic impacts are significant for growers, as affected carrots are either discarded or substantially downgraded in value.

The Australian vegetable industry has highlighted the need for improved knowledge on the causes of the disease complex. This project examined the conditions conducive to the development of carrot crown rot disorders in Tasmanian production regions.

About the project

Project VG15066 aimed to identify causes of carrot crown rot disorders over two crop seasons in 2016/17 and 2017/18. Carrot samples, including rejects, were collected from three major fresh market processors in Tasmania (Sumich, Harvest Moon and Premium Fresh Tasmania) during the peak harvest period. Field samplings and inspections were also carried out in some of the crops.

Diagnostic examinations identified five different types of carrot crown symptoms that may affect carrot marketability. Four were carrot crown rots (ring crown rots, smooth crown rot, corky crown rot and soft watery crown rot) and one was a carrot blemish (black ring). Carrots that have the crown rots are unmarketable. Carrots with black rings are still marketable, but most will be downgraded to low-grade carrots, drastically reducing returns to affected growers.

Major findings

The project described the different soil factors and field conditions found in association with each type of crown rot symptoms. Weather conditions and soil conditions were found to be major factors in the development of crown rots.

Soil compaction and soil crusting that occurred in crops sown under prolonged wet weather episodes such as those experienced in 2016/17 displayed increased incidence of crown rots (approximately one third of 30 crops harvested and surveyed were affected), as well as other major defects such as forked and misshapen carrots. This was largely due to soil compaction and soil crusting creating a restrictive zone around the crown of the carrot.

By contrast, unusually dry weather during 2017/18 saw a low incidence of crown rot, with soil conditions ideal for carrot seed drilling and root growth. Any disease detection was often localised to small areas in a paddock where there was soil compaction, erosion or poor drainage.

Physical injury followed by fungal infections is believed to have caused many crown rot symptoms observed.

The fungus *Fusarium avenaceum* was almost always isolated from all the different types of crown rot symptoms and different crops. *F. avenaceum* is a common Fusarium pathogen in soil, and carrot injuries are likely to pre-dispose them to infections by the pathogen.

High levels of stones, cloddy soil, poor drainage and soil crusting also contributed to increased levels of ring crown rot and smooth crown rot, while corky crown rot appeared to be related to the exposure of carrot crowns to fluctuating surface soil moisture and temperature. Black ring or soft watery crown rot was linked to conditions that result in leaf damage and early leaf senescence, and symptoms can be reduced by practices that improve air flow and foliar disease control.

Techniques optimising ground preparation are also recommended. During unfavourable conditions, growers should focus on maintaining the surface of the soil as close to field capacity as practically possible during early stages of crown development, and avoid over-irrigation. Growers should also explore methods to remediate the soil surface post cultivation to shatter the crusting formed in the surface layer. This would increase the friability of the surface, reducing the friction between the crown and the soil.

Ensure that carrot crowns are covered with soil to protect them from extreme fluctuations in soil moisture and temperature on soil surfaces.

Conclusion

Physical injury followed by fungal infections is believed to be the cause of most of the different crown rot symptoms observed. Adequate soil management, favourable climate and monitored irrigation are all critical factors that can reduce the incidence and severity of carrot crown rot and increase carrot pack-out.

Corky crown rot.
Image courtesy of Dr Hoong Pung.

Soft watery crown rot.
Image courtesy of Dr Hoong Pung.

Ring crown rot.
Image courtesy of Dr Hoong Pung.

Smooth crown rot.
Image courtesy of Elizabeth Jolly.

Acknowledgments

This project is a strategic levy investment under the Hort Innovation Vegetable Fund.

VG15066 has been funded by Hort Innovation, using the vegetable research and development levy and contributions from the Australian Government. Peracto Pty Ltd is grateful to Sumich, Harvest Moon and Premium Fresh Tasmania for their assistance with surveys and sampling.

VG13051 – On-farm power generation – options for vegetable growers

Facilitators

Project VG13051 was completed by Applied Horticultural Research with Parkside Energy in 2014. An update to the report was published in 2017.

Introduction

Vegetable growers consume significant amounts of electricity, particularly through irrigation, cooling produce and operating processing facilities. With electricity prices rising across Australia, growers are dealing with increases to what is already a major operational cost.

Meanwhile, some forms of renewable energy have become cheaper to install and a number of incentive schemes have been offered. This has introduced possibilities for growers to reduce energy costs and meet sustainability goals.

About the project

With on-farm power generation identified as a potential way for growers to supply or supplement their use of electricity, Project VG13051 aimed to produce an analysis of the various options available and the economic and technical feasibility of adopting these systems.

The project team from Applied Horticultural Research (AHR), with consultants Parkside Energy, studied technologies that were well-established and in common use in 2014. These included: solar photovoltaics (PV), wind power, natural gas generation, Liquefied Petroleum Gas (LPG) power, woody biomass power generation (burning wood to generate electricity) and micro-hydro power generation.

The project report detailed the approximate investment required and the likely reductions in power costs for each option, as well as assessing feasibility, taking into account regulatory requirements, incentives and impediments.

The project also undertook six detailed case studies on vegetable farms across Australia. The case studies took place on a variety of farms, including some that had on-farm power generation already set up and some that did not. The case studies also included farms with and without on-farm processing.

Major findings

The project found that two forms of on-farm power generation were viable options for vegetable growers: solar PV and wind.

Solar PV should be economically viable for most growers, including those in less sunny regions, provided electricity costs are more than 12-15 cents per kWh.

Wind power was found to be viable if the cost of electricity is more than about 10 cents per kWh and if most of the electricity generated can be used on-site.

"Our study found that solar PV and wind were the only two viable forms of electricity generation," AHR Project Lead Dr Gordon Rogers said.

"In most cases, solar PV is the best option. If the pattern of energy usage matches daylight hours, then solar is best. If there is sufficient wind where a farm is located, and the wind patterns are suitable, then wind generation can be a better option. However, suitable locations for wind are less common than for solar."

In 2014, incentives included the Renewable Energy Target (RET) subsidies and feed-in tariffs. While RET subsidies have fallen significantly since then, they are still in place on a reducing scale until 2030. Feed-in tariffs have generally been closed or reduced. The project team produced an update to the final report in 2017, outlining the changes.

"It is much more efficient for growers to use as much of the electricity they produce onsite as possible, and to not rely on feed-in tariffs," Dr Rogers explained.

Although incentives have declined, Dr Rogers noted that capital costs for installing on-farm power generation have also reduced, which means solar PV and wind power are still economically viable for growers.

Finally, the initial report assessed battery storage as not viable in 2014, but the 2017 update noted that it is expected to be a viable option in three to five years, as installation costs continue to drop.

Conclusion

Growers are advised to consider their current costs of electricity, usage patterns and peak usage times before deciding whether to invest in solar PV or wind power. A series of fact sheets have been produced to assist growers. These are available online at ahr.com.au.

"My advice would be to find reputable installers and get two to three quotes on installing solar PV," Dr Rogers said.

He also advised that growers look for other ways to reduce their energy use on-farm.

"In particular, check whether you are paying additional peak usage charges, and consider ways in which you can reduce these. There are significant savings that can be made by improving energy efficiency on farms."

Acknowledgments

This project is a strategic levy investment under the Hort Innovation Vegetable Fund.

VG13051 has been funded by Hort Innovation using the vegetable research and development levy and contributions from the Australian Government.

The bottom line:
Improved knowledge of factors contributing to carrot rot (VG15066)

Carrot crown rot disease can substantially reduce carrot pack-out and may affect carrot marketability.

Weather, soil conditions and physical injury followed by fungal infections appear to be major factors in the development and severity of crown rots in carrots.

Soil compaction and soil crusting in crops sown under wet weather conditions had increased incidence of crown rots, as well as many other physical carrot defects likely to be associated with poor soil conditions such as twisting, short stubby tap roots, growth cracks, cavities or forking.

Project VG15066 found techniques that optimise ground preparation will aid prevention, and growers should also focus on maintaining the surface of the soil as close to field capacity as practically possible during early stages of crown development.

It is vital to maintain a friable soil surface around the carrot crown, particularly at the early crop stages, with ongoing monitoring of soil moisture to avoid or reduce crusting of the topsoil.

Further information

For more information, please contact Dr Hoong Pung on 0409 400 063 or hpung@peracto.com.

The final report for this project is available on InfoVeg. Readers can search 'VG15066' on the InfoVeg database: ausveg.com.au/infoveg/infoveg-database.

The bottom line:
On-farm power generation – options for vegetable growers (VG13051)

With electricity costs rising across Australia and on-farm power generation identified as a possible way for vegetable growers to save money, Project VG13051 sought to analyse the different options available and assess the economic and technical feasibility of each.

Researchers found only two options viable for vegetable growers: solar photovoltaics (PV) and wind power.

Solar PV is likely to be viable for most growers, even those located in less sunny regions. Wind power can be viable if most of the electricity generated can be used onsite; if there is sufficient wind in the farm's location; and if wind patterns match usage.

Financial incentives that were available in 2014 have since declined, although subsidies are still in place on a reducing scale until 2030. Growers are advised not to rely on these, but instead to use as much of the energy produced onsite as possible and to look for additional ways to improve energy efficiency.

Further information

For more information about the project or the 2017 update, please contact Dr Gordon Rogers at Applied Horticultural Research at gordon@ahr.com.au.

To access the project's fact sheets please visit ahr.com.au and search for VG13051.

The final report for this project is available on InfoVeg. Readers can search 'VG13051' on the InfoVeg database: ausveg.com.au/infoveg/infoveg-database.

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Please contact Michelle De'Lisle at AUSVEG via email at michelle.delisle@ausveg.com.au or call 03 9882 0277 to submit topics for potential inclusion in future editions of *Vegenotes*.

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