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ADVANCED STABLE FLY MANAGEMENT FOR VEGETABLE PRODUCERS – VG15002

IMPROVED MANAGEMENT OPTIONS FOR CUCUMBER GREEN MOTTLE MOSAIC VIRUS – VG15013

VG15002 – Advanced stable fly management for vegetable producers

Facilitators

Project VG15002 was undertaken by the Western Australian Department of Primary Industries and Regional Development. It was completed on 30 September 2018.

Introduction

In recent years, horticulture has expanded into areas in and around the Swan Coastal Plain in Perth, where there is a high volume of livestock farming. This has resulted in an increase in stable fly outbreaks, as the larvae of this fly thrive in rotting plant material, while the adult flies blood-feed several times a day on any nearby livestock. The flies' painful bite distresses the animals, causing reduced feeding and increased heat stress in summer, which in turn results in significant production losses for livestock farmers.

Crop residues left after harvesting vegetables create the perfect environment for the stable fly to develop, with up to 1,000 stable flies developing per square metre of vegetable production. As little as 20 flies on one animal will begin to affect production gains, and up to 1,000 stable flies have been found on livestock located close to major vegetable producers.

It is therefore important to greatly reduce stable fly numbers in this region. If numbers remain at current levels, it is likely that local shires may limit the future expansion of horticulture into the area.

About the project

Project VG15002 aimed to find an effective way to curtail numbers of stable flies. The Western Australian Department of Primary Industries and Regional Development (DPIRD) worked with local growers to implement trials to test numerous methods.

These methods included: the use of agricultural machinery for handling post-harvest residues; the use of biological control options including fungi that are lethal to insects, staphylinid beetles which are predators of stable fly eggs, and parasitic wasps; and a walk-through trap that aimed to remove stable flies from severely affected cattle.

"A combination of laboratory and replicate small- to large-scale field trials over multiple properties and using a variety of crop residues were undertaken to assess various methodologies," DPIRD senior entomologist and stable fly researcher Dr David Cook said.

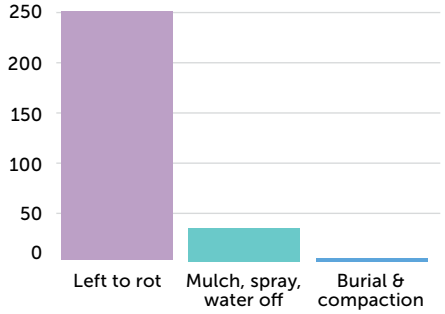
Many of these methodologies were found to have limited success or were deemed neither practically nor economically viable for vegetable producers to adopt. One method, however, emerged as the most effective for reducing stable fly numbers – that of burying crop residues and compacting the sandy soil above the residues.

Major findings

The DPIRD team found two simple steps for managing stable fly numbers. Step one is burial of crop residues seven days after harvest using either a mouldboard plough, stone burier or a deep, slow rotary hoe. Step two is compaction of the sandy soil using a fixed landroller at rates equivalent to five tonnes per square metre (5t/m^2).

This method essentially traps the developing stable flies beneath the compacted soil, preventing them from emerging and feeding on livestock.

"I was surprised by the ability to almost totally prevent adult stable fly emergence from sandy soils when compacted," Dr Cook said. "This method of controlling insects and, particularly nuisance flies, has never been used before. It's such a simple, yet highly effective, method of control without the need for pesticide use."



Number of stable flies emerging/m² from crop residues buried and then compacted (8 field trial results combined) as compared with either no treatment of the residues, or applying the previous Best Management Practice of mulching the residues, spraying an insecticide and turning the irrigation off.

Waiting one week after harvest is completed removes more stable flies from the population, as it gives the flies time to lay eggs on the soon-to-be-buried residues, rather than allowing them to find an alternative laying material.

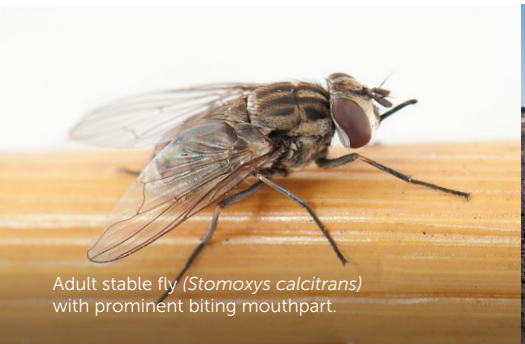
Conclusion

Dr Cook believes this method of disposal of post-harvest vegetable residues has application nationally as the most hygienic and cost-effective stable fly management method, with no pesticide usage and complete organic matter retention.

"All the organic matter from the residues is retained in the soil, there is minimal soil tillage and less use of machinery, there is no need to use any pesticides, and the compact, moist sand is less prone to wind erosion," he explained.

Dr Cook noted that this method may be problematic in different soil types, such as heavy loams and clay soils, however these soil types do not support the survival of stable fly larvae as they remain too moist and have little air space between soil particles.

Due to the significant success of the burial and compaction method, Dr Cook says it is unlikely that further research on this topic will be required.



Adult stable fly *(Stomoxys calcitrans)* with prominent biting mouthpart.

A fixed land roller compacting the sand after mouldboard ploughing.

Acknowledgments

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

VG15002 has been funded by Hort Innovation using the vegetable research and development levy and contributions from the Australian Government.

VG15013 – Improved management options for cucumber green mottle mosaic virus

Facilitators

Project VG15013 was completed by the Northern Territory Department of Primary Industry and Resources with support from NT Farmers and state organisations from Queensland, Victoria, Western Australia and New South Wales.

Introduction

The discovery of cucumber green mottle mosaic virus (CGMMV) in cucurbit crops in northern Australia in September 2014 resulted in affected properties being quarantined in order to prevent the spread of the highly transmissible virus.

Recognising the impact of the incursion on cucurbit growers, researchers in Project VG15013 investigated ways to manage the virus through on-farm biosecurity practices as well as improving the speed and accuracy of CGMMV diagnostics.

About the project

Following the detection of CGMMV in cucurbit crops in 2014, it was concluded that the primary cause of the incursion was through contaminated seed. However, researchers quickly discovered that the virus was a highly stable particle which could persist in plant material, soil and water, which made it very easy for the disease to spread mechanically between crops.

"In the period after the incursion, we really set out to find out as much as we could about how the virus survived, what crops it infected, and how to best manage its spread to other plants, which led to our investigation into how that might actually happen," Northern Territory Department of Primary Industry and Resources Principal Plant Biosecurity Officer Dr Lucy Tran-Nguyen said.

According to Dr Tran-Nguyen, one of the objectives of Project VG15013 was to identify potential hosts for the virus.

"As well as developing a list of known CGMMV hosts, including potential weed hosts, we also sought to identify non-host species that growers could plant in the event that the virus made growing cucurbits unviable in the area."

Due to the highly transmissible nature of CGMMV, fast and accurate detection of the virus became an increasing concern for growers.

"During the incursion, we felt that the existing field diagnostic tools were inadequate and didn't offer sufficient accuracy for detection of the virus. It was clear that we needed to investigate alternative technology for use in the field," Dr Tran-Nguyen said.

Major findings

VG15013 resulted in a number of important outcomes for the management of CGMMV.

The first was a better understanding of the nature of the transmission of the CGMMV virus, which led to the compilation of on-farm management practices that growers can use to minimise the risk of spread of the disease between farms.

The second was the validation of a new dipstick diagnostic test kit to provide a fast and accurate in-field diagnostic solution for the detection of CGMMV. This kit is commercially available.

Another interesting finding during the research was strong evidence that honeybees had a role in moving CGMMV, leading to the development of management practices for beekeepers to minimise virus transmission to cucurbit crops.

"Hive testing found that CGMMV was present in all hive products, including adult bees, brood, honey, pollen and wax; but only the live virus in honey, adult bees and pollen. However, questions still remain regarding how the bees move the virus around the environment," Dr Tran-Nguyen said.

"We still don't understand whether honeybees can move the live virus from their hive to infect clean plants, which would present a significant risk if hives are moved between locations."

Conclusion

By better understanding the life cycle of CGMMV, the researchers were able to develop some on-farm biosecurity practices to better manage the disease and its impact on the industry. Dr Tran-Nguyen said that growers have been proactive in implementing biosecurity practices on-farm, such as restricting farm visitor access, minimising entry and exit of vehicles, using footbaths and cleaning and disinfecting tools and machinery.

"We've been very pleased to see the increase in these on-farm practices, as well as other measures such as removing potential weed hosts, and disposing suspect plants using methods that reduce the risk of infection.

"Growers now also understand the importance of sourcing their seed from reputable sources, reducing the risk of crop contamination in the future."

Dr Tran-Nguyen has developed a series of fact sheets for growers and beekeepers outlining the outcomes of the research, including management practices that cucurbit growers can use to prevent the spread of CGMMV and strengthen on-farm biosecurity. These fact sheets are available online at dpir.nt.gov.au.

CGMMV infected plants.

Acknowledgments

This project has been funded by Hort Innovation, using the vegetable industry research and development levy and contributions from the Australian Government. Hort Innovation is the grower owned, not-for-profit research and development corporation for Australian horticulture.

Adult fly emergence cages over the compacted sand to measure adult stable fly emergence.

The bottom line:
Advanced stable fly management for vegetable producers (VG15002)

Stable flies have become an increasingly serious pest of the livestock industries around Perth, due to horticultural expansion in the area. Stable fly larvae develop in crop residues that remain after harvesting vegetables. Once developed, adult flies blood-feed on nearby livestock, causing distress to the animals and resulting in production losses for livestock farmers.

Project VG15002 tested a variety of management methods, including the use of biological control options and a walk-through fly trap for severely-affected cattle.

The method that emerged as the most effective involves burial of the crop residues seven days after harvest, followed by compaction of the sandy soil. This traps the adult flies that develop from the larvae under the hard layer of soil, effectively killing them.

This method provides key production benefits to growers as all organic matter from residues is retained, there is less wind erosion and insecticides are not required.

Further information

For more information, please contact Dr David Cook at the Western Australian Department of Primary Industries and Regional Development at david.cook3@dpird.wa.gov.au.

Stable fly images courtesy of the Western Australian Department of Primary Industries and Regional Development.

CGMMV infected plant.

The bottom line:
Improved management options for cucumber green mottle mosaic virus (VG15013)

Project VG15013 sought to understand the mechanism for the spread of cucumber green mottle mosaic virus (CGMMV) in cucurbit crops and the identification of management practices to prevent its spread.

Researchers identified host plants, including weeds, which were susceptible to the virus, as well as a number of crops that were not impacted by the virus that could be grown as alternative crops.

The project also identified the need for new in-field diagnostic technology to provide faster and more accurate detection of the virus. A new dipstick test kit is now commercially available.

Researchers also identified the potential link between honeybees and the spread of CGMMV, however more research is required to draw conclusions regarding the mechanism for transmission between beehives and crops.

A series of fact sheets have been developed outlining on-farm management practices for the prevention of the spread of CGMMV, and are available online.

Further information

For more information, please contact Dr Lucy Tran-Nguyen from the Northern Territory Department of Primary Industry and Resources at lucy.tran-nguyen@nt.gov.au.

To access the project's fact sheets please visit dpir.nt.gov.au.

CGMMV images courtesy of the Northern Territory Department of Primary Industry and Resources.

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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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