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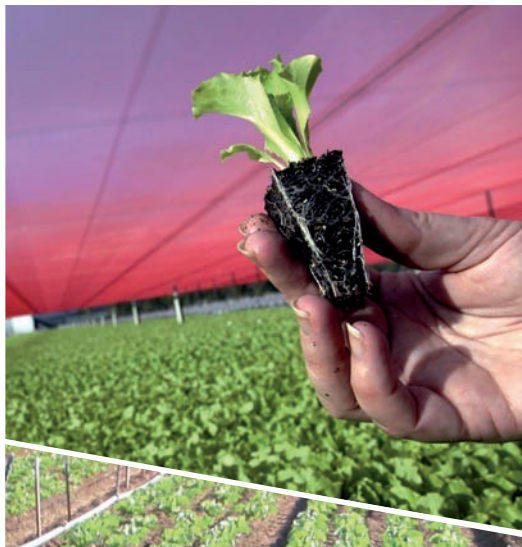
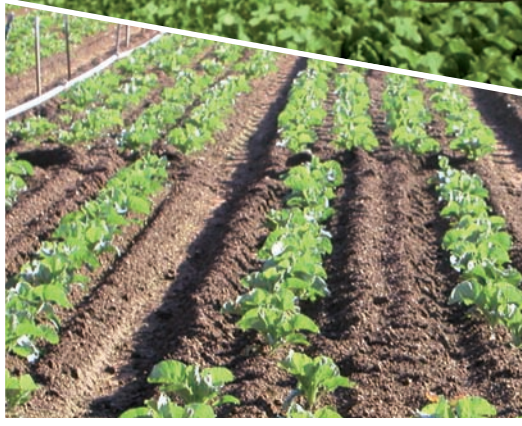
Disinfestation of sweet corn for export using phosphine and controlled atmospheres

Project no: VG01014

New fumigation methods for exported vegetable crops destroy pests while maintaining product quality.





Control of slugs in the Australian vegetable industry

Project no: VG08152

New strategies for risk assessment and control of slugs.

Disinfestation of sweet corn for export using phosphine and controlled atmospheres

Introduction

Australia produces 62 million tonnes of sweet corn each year. Japan is the industry's strongest export market and, while there is considerable scope for further growth in other countries, reports of live insects in shipments may hinder progress. This project outlines fumigation alternatives to methyl bromide, which have been identified by the Department of Agriculture and Food Western Australia. The research data satisfies international standards of quarantine treatment required for market access of Australian sweet corn to all countries imposing restrictions against specified pests.

Quarantine treatment

Fumigation with methyl bromide is the current quarantine treatment for a range of pests, however, there are a number of drawbacks; methyl bromide is phytotoxic to sweet corn, it shortens shelf life and also depletes the ozone layer. Its scheduled phase-out by 2015 under the Montreal Protocol has also made the fumigant increasingly expensive. Alternative scientifically-proven and commercially-viable fumigation treatments are needed in order to help the industry reach its full export potential.

Fumigation alternatives

Rapid removal of field heat is important for preserving the quality of sweet corn, while maintaining relative humidity at more than 95 per cent to reduce moisture loss. The challenge for researchers was to develop a fumigation treatment that did not damage sweet corn, while permitting treatments in the shortest possible period over a range of temperatures that fitted within the cool chain process.

Insect tubes placed in bulk bins for fumigation.

The research on alternatives to methyl bromide was carried out using international trial protocols, which require extremely high levels of disinfestation to be demonstrated through a carefully conducted series of experiments. Several hundred experiments were conducted over a six-year period between 1999 and 2006.

Key outcomes

A new fumigant combining ethyl formate with carbon dioxide, commercially known as Vapormate®, was found to be very effective in destroying the corn earworm, Helicoverpa armigera, native budworm, H. punctigera, two spotted spider mite Tetranychus urticae, plague thrips Thrips imaginis, western flower thrips Frankliniella occidentalis, green peach aphid Myzus persicae and corn aphid Rhopalosiphum maidis at temperatures ranging from 10 to 20°C and exposure periods from two-four hours.

The treatment fits in well with the cool chain process and does not have any adverse effect on the quality of fresh harvested sweet corn. In addition, no residues of ethyl formate were found in treated produce. Ethyl formate is a safe product that occurs naturally in Brassica vegetables and in food grains, and has no harmful effect on the environment.

On the basis of the large body of laboratory and large scale trial data, an AQIS-endorsed treatment schedule for disinfestation of quarantine pests has now been developed. This schedule has a lower dose rate than the label rate for Vapormate® and considerably reduces treatment costs while remaining completely effective.

A. Tolerant species:

1. Cotton bollworm or corn earworm Helicoverpa armigera (Hübner)
2. Native budworm or Australian bollworm Helicoverpa punctigera (Wallengren)

>21 °C cooling to 20 °C
Ethyl formate (30g /m3) or Vapormate® (180g /m3) for 4 hours

20 °C cooling to >15 °C
Ethyl formate (40g /m3) or Vapormate® (240g /m3) for 4 hour

15 °C cooling to >10 °C
Ethyl formate (44g /m3) or Vapormate® (264g /m3) for 4 hour

B. Susceptible species:

1. Two-spotted spider mite Tetranychus urticae (Koch)

2. Western flower thrips Frankliniella occidentalis (Pergande)
3. Plague thrips Thrips imaginis (Bagnall)
4. Green peach aphid Myzus persicae (Sulzer)
5. Corn aphid Rhopalosiphum maidis (Fitch)

>21 °C cooling to 20 °C
Ethyl formate (20g /m3) or Vapormate® (120g /m3) for 2 hours

20 °C cooling to >15 °C
Ethyl formate (24g /m3) or Vapormate® (144g /m3) for 2 hours

15 °C cooling to >10 °C
Ethyl formate (28g /m3) or Vapormate® (168g /m3) for 2 hours

Conclusion

The use of alternative treatments to methyl bromide is a sustainable way of managing the sweet corn industry into the future. The quarantine fumigation treatments determined by this project have been supplied to the Australian Quarantine and Inspection Service, Biosecurity Australia and the Australian Pesticides and Veterinary Medicines Authority. These new fumigation methods also have high applicability for many pests found in other exported vegetable crops.

The Bottom Line: VG01014

- The strong export potential of sweet corn has been limited by discoveries of live insects in shipments.
- Effective post-harvest disinfestation of produce is essential in order to satisfy the zero tolerance of live insects required by overseas quarantine authorities.
- A new fumigant combining ethyl formate with carbon dioxide has been found to be very effective in destroying pests and preserving product quality.

Preparing bulk bin fumigation.

Control of slugs in the Australian vegetable industry

Introduction

The accidental introduction of several species of slugs has created a range of problems for Australia's processing vegetable growers. This project aimed to provide the industry with better control solutions using field observations and existing information from previous Australian studies.

Unwelcome pests

Slugs can invade a paddock from a weedy edge or can build up with favourable rotations such as pasture or irrigated lucerne. They directly feed on vegetable plants, and can also contaminate harvested crops such as processing peas. Once a paddock or farm has a serious slug problem, it is very difficult to control; individual slugs can lay more than 1,000 eggs, so a population can increase rapidly. With an essentially unlimited food supply (the crop), a perfect environment (moist, shelter) and few or no predators, slug populations can easily reach damaging levels.

Monitoring

An assessment of risk of damage by slugs needs to be made before the crop is planted. This means taking into account the numbers of slugs and the species present. It is also important to look for other pest species that can cause identical damage to slugs (in particular European earwigs).
Shelter traps are the easiest monitoring method and 30cm x 30cm tiles are good to use; place five tiles about two metres apart in areas of a paddock that are of most concern. Moisture beneath the tiles is crucial in order to attract the slugs, and predatory beetles and earwigs are also likely to shelter under the tiles. The species of slugs found will influence the impact of different control strategies.

SLUG IDENTIFICATION GUIDE

The worst offenders

Deroceras reticulatum (Grey Field or Reticulated Slug). The most common species of slug found in agricultural systems across south-eastern Australia. It becomes very active after rainfall, is very damaging and each individual can lay up to 1,000 eggs.
Milax gagates (Black Keeled Slug). This species can cause more damage per individual than the other species, and will only become active when the soil profile is wet. It is a true burrower and can better survive dry conditions than other species.
Deroceras panormitanum (Chestnut Slug). Generally smaller than the Reticulated and the Black Keeled slugs and less damaging per individual. This species is more likely to be a contaminant at harvest.
Lehmannia nyctelia (Striped Slug). Rarely a major pest and possibly a scavenger, as well as a plant feeder. It has a very different life-cycle with eggs hatching late August.

Controlling Slugs

Given that slugs are long-term residents within a paddock, control or management of a slug population needs to be considered for the paddock and not for a specific crop. The best chance of managing a population and keeping it below a critical level can be achieved by using a range of tools:

1. Bait
The amount of bait required will depend on the number of individuals present and, as slugs can foul baits with mucus, the

efficiency of baiting is lessened as the population size becomes higher. The most common reason for baits to fail is that the rate used is too low. Border bait at a higher rate if slugs are likely to come in from an edge.

2. Rotation
Some crops favour slugs more than others by providing a good habitat and food source. Other crops that are in for long periods of time such as lucerne, pasture, poppies and pyrethrum can bulk up populations simply because the paddock may only be cultivated and baited one year in three. Plant susceptible crops early, so that they do not sit in the vulnerable cotyledon stage for too long.

3. Tillage
Tillage can have a very big impact on slugs by removing their habitat and also by physically damaging them. Cloddy ground favours slugs by providing a habitat for them.

4. Burning
Removes slug habitat.

5. Native predators
Predators of slugs such as carabid beetles do not survive well in most horticultural situations, as they are easily killed by broad spectrum insecticides and rotary hoeing.

Summary

The information collated in this project has resulted in a guide to the most common species of slugs, along with a range of cultural or management options that can have a positive or negative impact on slugs. Preventing the build-up of slug populations is more effective than trying to deal with high populations in a vulnerable crop. Control measures must consider all crops in the rotation and growers need to be aware that a strategy may take several years before it produces a visible result.

The Bottom Line: VG08152

- When controlling slugs, aim to use as many of the biological, cultural and chemical options as possible.
- Make sure slugs are really the problem and target them according to species.
- Use rates of bait appropriate for slug numbers.


Milax gagates

Acknowledgements

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Photo credits:

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