PLANT AND SOIL NEMATODES

BIOSECURITY MEASURES TO REDUCE THE SPREAD OF POTATO CYST NEMATODE IN AUSTRALIA

The potato originated in South America and was brought to Europe in the 16th century. It was then taken to the rest of the world and now ranks in the top five of the world's food crops. South America was also the home of two destructive species of potato cyst nematode (PCN) that were also spread around the world with potato: the pallid form (*Globodera pallida*) and the golden form (*Globodera rostochiensis*). Details of the life history of these nematodes can be found in Fact sheet PSN 029. This sheet focuses on biosecurity measures that have been taken to limit the spread *G. rostochiensis*, which was first found in Australia in 1986.

Potato Cyst Nematode in Western Australia

PCN was identified on a farm near Perth in 1986 (Stanton 1986) and several adjacent properties in following years, with the final detection in 1989. As these were the first detections in Australia, infested properties were fumigated and quarantined immediately and a state-wide surveillance and eradication program commenced. Movement of machinery and equipment to other potato growing areas was prohibited and all solid and liquid wastes on infested farms were subject to deep burial.

Fortunately, the initial infestations were in market garden areas that became urbanised for housing and commercial use, and were widely separated from the main potato production areas. PCN-resistant potato varieties were initially mandatory in the PCN quarantine area but were also widely adopted in other regions of the state. Surveys for PCN commenced in 1989 and in the next 21 years, more than 30,000 samples were processed and no further infestations were detected. In 2006, a project was established to confirm that Western Australia was free of PCN. Historical survey records were examined, intensive state-wide surveys were conducted, soil from the original infested sites was bioassayed to check for the presence of PCN, and huge quantities of soil was processed and examined (Collins et al 2010). As viable PCN cysts were never detected, area freedom from PCN for market access was reinstated in 2010.

Potato Cyst Nematode in Victoria

G. rostochiensis was first detected in Victoria in February 1991. A potato crop in a small market garden at Wandin was showing early senescence and was found to be infested with PCN. Intensive surveys were then conducted and in the following year the nematode was found in several locations east and south of Melbourne, including Gembrook, Emerald, Keysborough, and Boneo. Further infestations were found at Koo Wee Rup/Cora Lynn in 2003 and Thorpdale in 2008. Quarantine control zones (radius 20 km) were established around infested properties but based on the results of a huge PCN soil testing program in other potato production areas of Victoria, the remainder of the state was considered free of the nematode.

There are several pathotypes of *G. rostochiensis* (distinguished by their capacity to multiply on *Solanum* clones with different genes for resistance), but the Ro1 pathotype is the only pathotype in Victoria. Recent molecular studies indicate that there was probably a single localised introduction of this pathovar followed by limited spread (Blacket et al. 2019), which means that commercial cultivars with resistance to the Ro1 pathotype have the capacity to keep PCN under control.

Quarantine procedures to minimise the risk of spreading PCN

Once it was clear that PCR was established in some parts of Victoria and was a threat to growers in other states and territories, the Australian potato industry developed a national plan aimed at limiting its spread (AUSVEG 2012). The most likely scenarios where PCN could be introduced to a farm, and the main pathways for spread of PCN were considered and it was recommended that the following regulatory, monitoring and control strategies be used in a coordinated manner to limit PCN entry and spread.

- Field surveillance programs to determine if PCN was present in an area, and define the boundaries of areas considered to be infested and other areas considered free of the pest
- Actions to be taken in response to a new outbreak of PCN (e.g. determination of the species and pathotype, and the extent and possible source of the infestation), and practices that could be used to manage a new PCN detection
- Farm hygiene practices to minimise the risk of introducing PCN to a farm, lessen the risk of spread, and protect Australia's ability to continue to trade in potatoes domestically and internationally without restrictions due to PCN

- Regulatory guidelines to ensure all land used for potato production is registered with state quarantine authorities; that growers keep accurate records of sampling events; and on-farm staff are aware of the sampling protocols to be used in detection and monitoring surveys
- Protocols to ensure that potato growers and packaging and processing facilities record consignments delivered to their facility, collect appropriate soil samples before potatoes are washed, and forward them to a certified laboratory for testing
- Procedures for collecting soil samples from potato fields in various risk categories and production zones, and details on how to retrieve a representative soil sample from harvesters and grading lines
- Extraction and molecular procedures to be used by approved laboratories to process samples and determine whether PCN is present
- Soil adherence and washing standards to be used to achieve a level of potato cleanliness that minimises the risk of spreading PCN
- Procedures for certification of PCN-free seed
- A list of cultivars with a high level of resistance to the Ro1 strain of *G. rostochiensis* that can be used to prevent multiplication of PCN

One important component of the plan was to subdivide land into risk categories and risk pathways so that the practices used to manage PCN would be determined by the risk category given to a certain piece of land. Risk categories were based on the likelihood that PCN would spread from a given location. For example, land designated high risk was known to be infested with PCN or had some connection to infested land (by ownership, shared machinery, or shared watercourses), and had a history of regularly growing potato crops that were not resistant to PCN. Land used for production of seed potatoes destined to be planted off-farm was also considered very high risk unless it met specific requirements such as being virgin land or land that had gained area freedom status and was subject to ongoing surveillance.

The key risk pathways for natural or assisted spread of PCN through movement of cysts with soil or host material were categorised in the same way. Thus, non-certified seed potatoes and tubers from properties that did not have verified 'area of freedom status', and situations where equipment, machinery, bins, potatoes, nursey stock, bulbs, and root crops could be moved from infested to non-infested areas were classified as very high or high risk.

A national PCN management program

In 2013, industry and governments established a harmonised PCN management system. Thus, all states now have surveillance programs that provide PCN-free farms with property-freedom status, and seed potato producers with documentation that allows them to access markets in most other states. Changes were also implemented so that there were fewer restrictions on properties that were previously within 20 km of an infested property but were not historically infested or linked in some way to the infested property.

Implementation of extensive surveillance-based soil sampling programs; strict hygiene procedures; enforcement of restricted movement regulations; the extensive use of PCN-free planting material; and the widespread adoption of PCN-resistant cultivars has been effective, as no new infestations of PCN have been reported in Australia in the last 15 years.

Literature cited

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