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Potatoes NEW ZEALAND

Technical Bulletin

What you need to know

Potato Cyst Nematode in New Zealand's Potato Crops

Written by Laurie Winkless for Potatoes NZ Inc.

Summary

Potato cyst nematode (PCN) is a pest that affects potato growers all over the world. Transmitted through the movement of infested soil, it has the capacity to severely reduce yields and restrict access to export markets. Once PCN becomes established on a piece of land, it is very difficult to remove.

This factsheet provides information on this nematode, as well as laying out the practical steps you can take to manage the risk, and prevent PCN from affecting your crop.

What is Potato Cyst Nematode?

Potato cyst nematode (PCN) is a pest – the most economically important parasitic nematode of potatoes[1]. It can be found in all temperate potato-growing regions, with its two species (*Globodera pallida* and *Globodera rostochiensis*) believed to be responsible for the loss of 9% of the crop worldwide.[2]

The nematode is characterised by the cysts it forms – these are hard, protective shells that each contain hundreds of eggs. Cysts are highly durable, and can remain dormant in the soil for up to 20 years. Once stimulated to hatch by the presence of water and host crop roots (such as potatoes), the emerging nematodes penetrate the roots and feed on them, reducing water uptake by the plant. This can lead to poor development of the tubers, and longer-term, it can greatly impact yield.

PCN cysts. Image © United Nations, 2014 UNECE (ECE/TRADE/416) 2014. © SASA

PCN has been present in New Zealand since 1972 and is managed through industry advice and grower practices. It has not been under any official government control programme since 1980.

How does PCN spread?

Potato cyst nematode – plus a wide range of other diseases, including verticillium wilt, violet root rot, common scab, powdery scab and PMTV – can be spread when soil is moved between fields and from one farm to another.

[1] Gartner, U., Hein, I. et al. "Resisting Potato Cyst Nematodes With Resistance," *Frontiers in Plant Science*, March 2021, Volume 12, Article 661194
[2] Turner, S. J., and Subbotin, S. A. "Cyst nematodes," in *Plant Nematology*, eds R. N. Perry & M. Moens (2013) Wallingford: CAB International, 109-143.

Therefore, the main risk vectors for spreading PCN are:

- Seed tubers, particularly saved seed from uncertified crops
- Soil on machinery, boots, vehicles, grazing stock, etc.
- Waste from table or processing potatoes, such as reject tubers, water from washing, and soil.

Potatoes (including volunteer potatoes in other crops) are the main host of PCN. But other solanaceous crops and weeds, such as nightshades, can also contribute to the long-term survival of PCN.

What impact does PCN have?

It causes the root systems of infected plants to develop poorly, with distorted or small tubers. Crop yields generally decrease as infestation rates increase. PCN may not initially be detectable above ground, but as population densities increase, the leaves of infected plants may be seen to wilt, and often have spindly stems.

If the PCN population is above the damage threshold of 15-20 cysts per millilitre of soil, potato yields can be severely reduced. And once PCN becomes established on a piece of land it is very difficult to eradicate.

MPI has an official assurance programme for potato exports, and so PCN infestation can affect access to New Zealand's export market.

What can we do to minimise risks?

Prevention is name of the game!

Using certified seed potato crops grown in New Zealand is a vital first step. They are monitored for PCN as part of an industry-wide certification programme, greatly minimising the risks posed.

It is recommended that any land with an unknown history (e.g. leased land) is tested for PCN in advance of planting. This involves specialists collecting core samples from the property and processing them in a laboratory.

Day-to-day, the most effective way to prevent the spread of PCN is to restrict soil movement between areas.

What does prevention look like on-farm?

Seed potatoes: Commercial growers should only grow from NZ-certified seed potatoes.

Pre-plant soil testing: Before planting on land with an unknown history, seek out a crop consultant or an organisation such as AsureQuality Ltd or SGS NZ Ltd to perform PCN sampling.

Field hygiene: Soil movement must be restricted as much possible. Anything used in the field, e.g. machinery, tools, boots, bins and containers, can easily pick up soil that can be dislodged the next time the equipment is used. Even if just a small amount of that soil is infested with PCN or other soil-borne diseases, it can lead to a new area becoming contaminated. Soil is also easily picked up by vehicles driving through farms, and by animals grazing on pasture.

High pressure washing is the best way to remove soil and the potato cyst nematode from all items. For boots, remove any clods of soil with a stiff brush before washing them. Soil should also be removed before boots are disinfected or sanitised – the presence of organic matter can deactivate such compounds, making them less effective.

Boots can easily carry soil between fields and farms. Brush and wash boots to remove all soil.

All farms or blocks of land used for potato growing should have a specified 'washdown' area. (See text box for further information)

Processing hygiene: Waste such as reject tubers, wash water, and soil from processing factories or table potato packing operations can all carry PCN. Avoid spreading this waste onto fields or adding it to stock feed, as it can lead to new infestations. Potato washing water should be filtered or ponded with the settled sludge disposed of in a landfill.

Access management: Contractors and other visitors (e.g. sales reps and agronomists) may visit several farms in quick succession, so their vehicles can easily spread infested soil. Try to minimise the number of vehicles which enter your fields and also the number of entry points.

Use signage to provide contact phone numbers, and to direct visitors to the office. Keep a register of all visitors, and clearly communicate the location of sites for washing down equipment and boots.

Post signage at the main entry points to the farm.

Ensure that contractors are aware of the risks they pose and that they appreciate the importance of good farm hygiene in maintaining productivity. Consider including cleaning requirements in any contractual arrangements you have with contractors or other service providers that visit your property.

Help! PCN is on my farm, what can I do?

Once PCN is present in fields, it is very difficult to eliminate it. The objective now switches to management – minimising the impact on potato production and preventing spread to other fields. At low levels, PCN can have only a minor impact on yields. Depending on the soil type, PCN populations can decline over time, sometimes reaching levels that are below damage thresholds.

Resistant cultivars: Some potato cultivars are resistant to PCN, preventing the nematode from reproducing. Planting these cultivars is an important part of a grower's PCN control strategy. But remember, PCN includes two species of nematode (*Globodera rostochiensis* and *Globodera pallida*). Potato cultivars can be resistant to one, both, or neither. Therefore, it is vital to find out which nematode species occurs on your farm, and select potato cultivars resistant to that species. Your seed supplier can provide guidance on the PCN resistance of common varieties.

Cultivar	*Globodera rostochiensis* resistance	*Globodera pallida* resistance
Agria	Resistant	Susceptible
Annabelle	Resistant	Susceptible
Fianna	Resistant	Partial resistance
Ilam Hardy	Susceptible	Susceptible
Innovator	Susceptible	Resistant
Moonlight	Resistant	Resistant
Nadine	Resistant	Partial resistance
Ranger Russet*	Susceptible	Susceptible
Rocket	Resistant	Partial resistance
Russet Burbank	Susceptible	Susceptible
Vivaldi	Susceptible	Susceptible

Resistance rating of the top ten potato varieties grown in New Zealand.[3]

[3] Potato cultivars which suffer less than 5% infection when grown in soils infested with PCN are categorized as "Resistant", while infection rates of 5-15% are categorized as "Partial resistance", and infection rates of over 15% result in that cultivar being categorized as "Susceptible". All resistance data is courtesy of Plant & Food Research except where marked with an asterisk, in which case data is from the website www.europotato.org.

Crop rotation: If cultivars *susceptible* to PCN are planted, then rotations of ten years or more between potato crops are the best strategy to suppress PCN populations. This extended timeline gives the nematode fewer opportunities to infest the crop, while reducing the number of viable cysts remaining in the soil.

If PCN-*resistant* cultivars are planted, then shorter rotations (as little as four years) may be possible, depending on soil type and location.

Tubers left behind at harvest (ground keepers) can regrow amongst other crops and can be enough to allow PCN populations to be maintained or even increase. The presence of ground keepers eliminates the benefits of crop rotation, and so they should be removed in intervening years.

Nematicides: Chemicals which kill nematodes – nematicides – can be an effective addition to a rotation strategy, particularly when a PCN-susceptible cultivar is planted. The only product currently registered for use in potato crops is Fenamiphos (under tradenames such as Canyon®, Fenafos 400, Nemacur®, and Nematek® 400EC). Speak with your agrichemical advisor for the best information on products and application.

Tips for creating a washdown area

1. **Location:** An open area close to property entrances and located as far as possible from growing areas
2. **Drainage:** Ideally a sump or a wastewater collection area for drainage of water, soil and plant debris. If this is not possible, ensure that wastewater does not run-off onto production areas
3. **Size:** Sufficient room for large machines and vehicles to enter and move around.
4. **Cleaning equipment**: Dedicated high pressure hoses or water-blasters
5. **Surface:** Concrete, gravel or bitumen is ideal. A grassed surface is not recommended, due to the potential for some pests to be spread by soil and on plant matter
6. **Timing:** Ideally cleaning will take place on the property the soil has originated from. Minimise transporting machinery and/or equipment to a new location for cleaning
7. **Signage:** Washdown areas should be signposted, with directions provided from the property entrance. This will ensure visitors are aware of its location, and can report to it on arrival.

In addition, a short checklist will help identify what needs to be cleaned on each piece of machinery. Tires, wheel wells, and any parts of the machinery in contact with the ground are the most important. But cleaning checklist should also include 'less obvious' areas, to ensure that all soil is removed.

Washing procedure for machinery and vehicles

- Dislodge any large clods of soil from the machinery before leaving the field
- Drive the machinery directly to the washing area, avoiding other fields if possible
- Wash with a high-pressure hose or water blaster, working from top to bottom.
- If the equipment has been used in a field known to be infested with PCN, it should be steam-cleaned after washing.