Barnyards PCN field trials 2022

Research summarised below has been carried out as part of the Scottish Government-funded PCN project, in collaboration between SAC Consultancy (SRUC) and Scottish Agronomy.

Delivering a sustainable potato industry for Scotland through management of Potato cyst nematode (PCN) is a project managed by the Plant Health Centre with Scottish Government funding. In 2022 a field trial was established which aimed to provide information on the integrated control of *Globodera pallida*. The full report "*A field trial investigating the resistance and tolerance characteristics of eleven potato varieties to Globodera pallida in Scotland*" can be found on www.pcnhub.ac.uk.

A field trial was planted at Barnyards Farm on 02/05/2022 - a location with a moderate-high PCN population (Figure 1). The trial consisted of 11 potato varieties (Cara, Maris Peer, Elland, Innovator, Eurostar, Buster, Amanda, Karelia, Cinderella, Lanorma, and Tyson) with varying levels of resistance to both *G. Pallida* and *G. Rostochiensis* (Table 1). Replicates of each variety were treated with either Nemathorin 10G (30 kg/ha, a.i. Fosthiazate) or left untreated.

Variety assessments

Initial PCN population (Pi) at planting (Viable cyst/eggs per gram of soil)

Initial PCN population (Pi) averaged 31.5 eggs/gram of soil (moderate to high population). Only *G. pallida* was observed in these soil samples.

Figure 1 - Arial image of Barnyards field trial site 2022.

Crop growth and development

Although individual varietal differences were observed, overall plots treated with Nemathorin treatment resulted in significantly improved emergence and groundcover development. There was no significant effect of Nemathorin application on the number of plants or in stem numbers.

Percentage dry matter

For five varieties (Cara, Elland, Eurostar, Buster, and Lanorma) the dry matter was under 18% with a small, but significant difference in dry matter in response to Nemathorin application (+ 0.2%) being observed. However, the somewhat high Nitrogen rate applied (210 kg/ha) uniformly across all varieties and treatments is likely to have had a detrimental effect on dry matter development.

Suitability for Prepack

All varieties tested were found to have potential as prepack varieties in Scotland. Exceptions being Innovator – a chipping variety with poor skin finish and Cinderella which has a dry matter more suited to crisping production.

Post-harvest PCN population (Pf) (Viable cyst/eggs per gram of soil)

The highly resistant varieties (Elland, Innovator, Eurostar, Buster, Amanda, and Karelia) all had reduced Pf values (between 0.9 - 11.9 eggs/gram) when compared with the average Pi of 31.5 eggs/gram (Figure 2).

Highly susceptible varieties such as Cara and Maris Peer, had a significantly higher Pf value (between 309 – 500). Similar increases in Pi were also observed for the partially resistant varieties, Lanorma and Tyson.

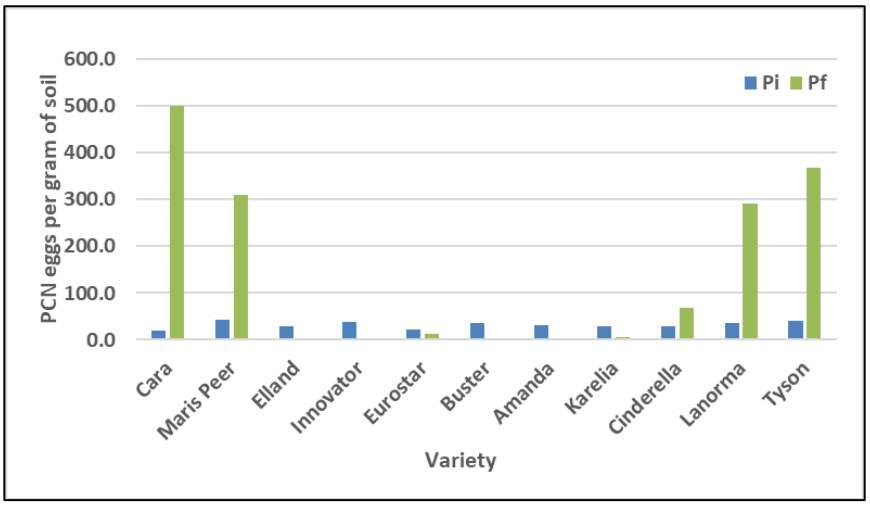

Figure 3 - Pre-plant (Pi) versus Post-harvest (Pf) PCN levels (eggs per gram of soil) for resistant and susceptible varieties

These results show that use of resistant varieties is highly important for PCN control moving forward. There was no significant effect of Nemathorin on the Pf values either overall or for different individual varieties (with the single exception of Maris Peer).

Tuber yield

Nemathorin application resulted in an average increase in total yield across all varieties of 7.6 tonnes per ha (16%). This was due to an increase in the larger size fractions at the expense of smaller grades. A significant yield increase following Nemathorin application was observed for Maris Peer, Eurostar, Buster, Amanda, and Cinderella, demonstrating the effect of PCN infection on crop yield, even in varieties resistant to infection (Figure 3, Asterisks). These varieties can be considered as intolerant to PCN, where tolerance is the ability of a potato variety to maintain yield in the presence of PCN. The yield of Elland and Karelia was not increased significantly by application of Nemathorin, and these varieties might be considered as more tolerant, however, additional trials across a range of conditions are required before tolerance can be described with confidence.

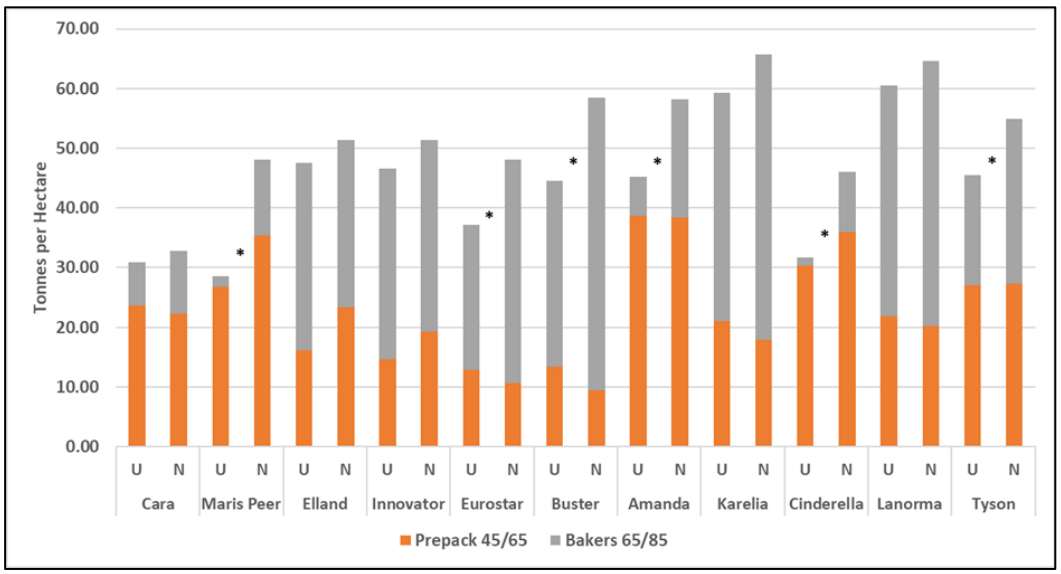

Figure 2 - Total yield (tonnes per ha) Nemathorin treated (N) and untreated varieties (U). Varieties with significant difference in total yield indicated by an asterisk.

Conclusions

- These results, summarised in Table 1, show the large effect that resistant varieties can have on the PCN population. Innovator, Elland, Eurostar, Buster, Amanda, and Karelia resulted in a reduction in the PCN population, while for both susceptible (Cara and Maris Peer) and *partially* resistant varieties (Lanorma and Tyson) there was a large increase in the PCN population.
- Nemathorin (Fosthiazate) treatment did not impact on PCN multiplication. However, treatment can protect the crop from the direct effects of feeding damage and yield enhancements were observed. This difference in yield can provide an important measure of the tolerance of a variety to infection. Nemathorin treated plots of Maris Peer, Eurostar, Buster, Amanda, Cinderella, and Tyson all showed a significant increase in yield, and based on this single trial, can be considered to be intolerant. Further understanding of tolerance in varieties is an important ongoing research topic, however it is a difficult characteristic to measure meaning further field trials are necessary.
- It is important to note that this study focused on *G. pallida* as this is the species of PCN prevalent at the trial site and more widely across Scotland. Growers and landowners should also have *G. rostochiensis* in mind as this species could increase in prevalence again and very few varieties have dual PCN resistance.

Summary of variety performance (Table 1)

Variety	Resistance to PCN		Comments
	G. pallida	*G. rostochiensis*	
Cara	2	9	Fully susceptible and tolerant control variety. Low yield due to short season.
Maris Peer	2	2	Fully susceptible and intolerant control variety.
Elland	9	3	Early maincrop with full resistance to *G. pallida*. Relatively tolerant. Moderate yield. Suitable for prepacking.
Innovator	8	2	Second early with full resistance to *G. pallida*. Considered to be intolerant. Widely grown for French fry production. Skin finish is unsuitable for prepacking.
Eurostar	9	9	Maincrop with dual resistance. Shown to be intolerant in this trial. Moderate yield. Suitable for prepacking and general use.
Buster	9	9	Late Maincrop with dual resistance. Emergence delayed. Shown to be intolerant in this trial. High yield. Considered suitable for prepacking.
Amanda	8	R	Medium early with dual resistance. Shown to be intolerant in this trial. High yield. Considered suitable for prepacking.
Karelia	8	8	Medium early with dual resistance. Shown to be relatively tolerant in this trial. High yield. Considered suitable for prepacking.
Cinderella	6	R	Early with partial resistance to *G. pallida*. Shown to be relatively tolerant in this trial. Lower yield. Considered unsuitable for prepacking due to high dry matter content.
Lanorma	5	9	Early maincrop with partial resistance to *G. pallida* and less suitable than fully resistant varieties in population management. Shown to be relatively tolerant in this trial. High yield. Suitable for prepacking.
Tyson	4	1	Maincrop with some resistance to *G. pallida* and less suitable than fully resistant varieties in population management. Shown to be intolerant in this trial. Moderate yield. Suitable for prepacking.