A field trial investigating the resistance and tolerance characteristics of nine potato varieties to *Globodera pallida* in Scotland (Year 3).

Kerry Leslie (SAC Consulting), James Price (James Hutton Institute) and
Eric Anderson (Scottish Agronomy)

May 2025

Contents

Introduction

On the 7th of August 2024, the open day for the third and final year of field trials for the PCN Action Scotland project was held. For more information on the PCN Action Scotland project, please visit: www.pcnhub.ac.uk. This field trial is part of a multi-year project to provide data on the integrated control of *Globodera pallida* (Work package 7) and to continue with knowledge exchange between the project and wider potato industry (Work package 8). The field trials are also an excellent opportunity to gather data for both work package 2 (Decision Support System) and work package 5 (Tolerance). Over 120 growers, agronomists, and potato breeders attended the open day for the 2024 field trial. At this event attendees also engaged with other work package leaders and outputs. This report combines the data and analysis from this trial. This research expands on the 2022 and 2023 trials by testing PCN resistant potato varieties with the application of two chemical actives, Velum Prime and Nemathorin.

The third year of the trial had variable weather conditions which may have contributed to differences in data. The 2024 spring was wet and cold leading to a delay in planting the trial until the 22nd of May. For comparison the 2023 trial was planted on the 3rd of May. There was a general lack of solar radiation in the 2024 growing season with many days being overcast. As with any field trial, we advise caution is taken when extrapolating data from a single year.

All statistical analysis were carried out using ANOVA tests. A copy of the following data including ad hoc statistics attached is available on request.

Field Trial Setup

The field trial was planted at Barnyards Farm (Grid reference 463 574) on 22/05/2024 - a location with a moderate to high PCN population (36.8 eggs/juveniles per gram of soil pre-planting of trial). The trial included nine potato varieties. Replicates of each variety were planted and treated with either Nemathorin 10G (30 kg/ha, a.i. fosthiazate), Velum Prime (0.625 L/ha in furrow a.i. fluopyram) or left untreated. All seed was treated with Rhino DSG (2 kg/t) prior to planting. All inputs into the trial were applied by the host grower and followed standard practice for ware crops in the region. The trial was flailed on 21/08/24 and treated with Spotlight plus (1.0 l/ha) on 27/08/2024 before harvest on 03/10/24.

Varieties

Details of the varieties including breeder, parentage, maturity, and the seed spacing used in this trial are given in Table 1. All varieties selected were the same as those used in the 2023 field trial with additions of Olivia and Bruar. Olivia and Bruar were selected to replace Lanorma for the last year of testing. The variety characteristics, including resistance to both main species of PCN, which have been taken from multiple sources including the potato variety database and information held by breeders is available in Table 2. The resistances of the trialled varieties to other prominent potato diseases have also been included.

Table 1 - Trial varieties, breeder, parentage, maturity, and seed tube spacing used.

Variety	Breeder	Parentage	Maturity	Seed spacing
Maris Piper	PBI Cambridge	(CPC 1673 x Ulster Knight) x (Arran Cairn x Herald)	Main crop	44 cm
Elland	Cygnet	Golden Millenium x Innovator	Early maincrop	32 cm
Eurostar	Stet	Victoria x Innovator	Main crop	31 cm
Buster	IPM	Innovator x ET5838/8	Late Maincrop	29 cm
Amanda	Solana	Epoka x SV66 123	Medium early	43 cm
Karelia	Europlant (Greenvale)	III 61659230 x Wentow 58 7 49	Medium early	25 cm
Bruar	Grampian Growers	Harmony x Valor	Early maincrop	30 cm
Olivia	Europlant (Albert Bartlett)	W 72 22 489 x VK 69 491	Medium Early	38 cm
Paradox	IPM	Amanda x Orla	Late maincrop	40 cm

Table 2 - Pest and disease resistance of varieties (Data from range of sources). 1: Highly susceptible – 9: Highly Resistant, S – Susceptible, R – Resistant.

Variety	Disease/Pest resistance (scale 1 - 9)							
	G. rostochiensis	*G. pallida*	Powdery scab	Blackleg	Common scab	Foliar Late Blight	Leafroll Virus	PVY^{O}
Maris Piper	9	**2**	3	5	1	4	4	2
Elland	3	**9**	4	6	6	4	5	3
Eurostar	9	**9**	4	4	5	S	-	S
Buster	9	**9**	4	6	7	6	-	S
Amanda	9	**8**	7	6	7	3	-	4
Karelia	8	**8**	-	High	High	-	-	-
Bruar	9	**6**	7	6	6	-	4	3
Olivia	9	**8**	Low	-	Low	-	-	-
Paradox	2	**7**	5	6	4	6	-	6

Assessments

Assessments were made before planting, during emergence and ground cover development, at harvest, and post-harvest.

Initial PCN population (Pi) at planting: Soil (500 g) was sampled from each individual plot before planting. These were assessed by FERA on 22/05/2024 to determine the initial number of cysts and eggs present and expressed as number of viable cysts and eggs per gram of soil.

Crop emergence: The emergence of each plot was assessed on 03/06/2024, 10/06/2024, and 17/06/2024 and expressed as the number of plants per 5 m of drill.

Foliage groundcover: The ground cover in each plot was assessed visually on 17/06/2024, 24/06/2024, 202/07/2024, 10/07/2024, 15/07/2024, 22/07/2024, and 29/07/2024. Results are expressed as a percentage (%).

Number of plants and stems: After haulm destruction a count was taken of the number of plants and stems present in 3 m drill lengths of each plot. This was assessed on the 03/10/2024. The results were expressed as number of plants and stems per 3 m length.

Dry matter and density: This was assessed by hygrometer for tuber samples from each plot and results were expressed as a percentage for dry matter and relative density. This was assessed on the 01/11/2024.

Post harvest PCN population (Pf): Soil (500 g) was sampled from each individual plot after harvest. These samples were assessed by FERA on 03/10/2024 to determine the number of cysts and eggs present and expressed as number of viable cysts and eggs per gram of soil.

Tuber yield and number: The central two drills of each plot were harvested. The harvested tubers were graded into different size fractions on 22/10/2024 (<25mm, 25-30mm, 30-35mm, 35-40mm, 40-45mm, 45-50mm, 50-55mm, 55-60mm, 60-65mm, 65-70mm, 70-75mm, 75-80mm, 80-85mm, and >85mm) using a 'smartgrader' with the yield and

tuber number in each size fraction determined. Results were expressed as tonnes/ha and tubers per ha. Total yield and tuber number was determined.

Internal defects (Rots, Spraing, Hollow heart, Internal rust spot, and watery wound rot): Samples of fifty tubers per variety were sliced to record the frequency of internal defects by Scottish Agronomy on 11/11/2024. Results are expressed as percentage of tubers with internal disease present.

Tuber skin finish and surface disease: Samples of fifty tubers per variety were retained in an ambient store and assessed on 11/11/2024. The tubers were washed and assessed for the presence of common scab (*Streptomyces scabies* spp.), powdery scab (*Spongospora subterranea*), black scurf (*Rhizoctonia solani*), Silver scurf (*Helminthosporium solani*) and black dot (*Colletotrichum coccodes).* Tubers were also assessed for splits and netting. Results are expressed as the percentage of tubers with infection (% incidence) and the average severity scores (scale of 0-3).

Results

Crop Emergence and Ground Cover

Generally there was an increase in emergence for plots treated with either Nemathorin or Velum Prime when compared to the untreated plots. On the first assessment date (03/06/24) Velum Prime treated plots had a statistically significant increase in number of plants per 5 m emerged. Velum Prime treated plots continued to be significantly increased compared to the untreated control for the second assessment date. By the third assessment date all treatments had reached equivalence.

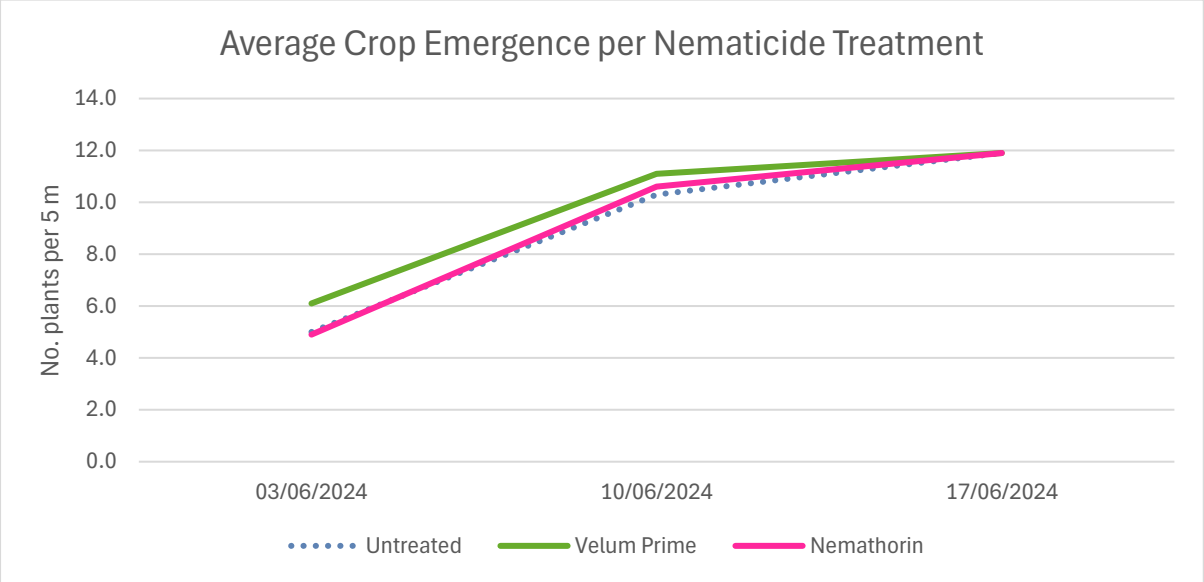

Figure 1 - Average crop emergence by nematicide treatment. Emergence counts were conducted 3 times over a two-week period.

When looking at the varieties on an individual basis, treatment with either Nemathorin or Velum prime has improved emergence and ground cover. It would reason that these treatments are allowing the crop to begin rooting with protection from nematode feeding damage early on. Comparisons between varietal emergence is not advised using this data given genotype-specific characteristics.

Table 3 – Crop emergence and ground cover. (U) Untreated, (V) Velum Prime treated, (N) Nemathorin treated.

	Emergence (N°/5m)						Ground Cover (%)											
Variety	**03/06/2024**		**10/06/2024**		**17/06/2024**		**17/06/2024**		**24/06/2024**		**02/07/2024**		**10/07/2024**		**15/07/2024**		**22/07/2024**		**29/07/2024**	
Maris Piper	1.0	cde	9.6	c	10.0	e	8.5	c	13.8	bc	28.3	b	48.8	bc	60.8	b	70.8	bc	84.2	ab
Elland	1.4	cd	8.8	c	10.0	e	5.9	de	7.8	d	12.5	d	22.9	e	28.3	f	46.7	e	54.2	e
Eurostar	10.2	b	12.7	b	12.8	c	15.8	a	20.4	a	50.0	a	74.6	a	76.3	a	84.2	a	90.0	a
Buster	0.3	de	4.6	d	8.5	f	4.7	e	8.3	d	20.0	c	32.9	d	48.3	de	61.3	d	70.8	cd
Amanda	10.6	ab	12.1	b	12.8	c	12.5	b	15.0	b	30.0	b	48.8	bc	53.8	cd	65.4	cd	71.7	cd
Karelia	11.5	a	15.2	a	15.6	a	12.1	b	15.4	b	29.2	b	47.5	c	53.8	cd	64.2	cd	71.3	cd
Paradox	2.1	c	9.0	c	10.4	e	7.3	cd	9.6	d	22.1	c	35.8	d	45.4	e	58.3	d	65.4	d
Olivia	0.2	e	9.3	c	12.1	d	8.2	c	12.1	c	29.6	b	56.7	b	66.3	b	79.2	ab	89.6	a
Bruar	10.8	ab	14.8	a	15.0	b	11.4	b	14.6	b	30.8	b	53.8	bc	60.0	bc	71.7	bc	79.6	bc
LSD P=.05		1.23		1.08		0.57		1.66		2.12		5.88		8.79		6.96		8.34		9.03
Std Dev		1.51		1.32		0.70		2.04		2.61		7.23		10.81		8.56		10.27		11.11
CV		28.38		12.41		5.86		21.27		20.07		25.77		23.08		15.63		15.36		14.78

	Emergence (N°/5m)						Ground Cover (%)											
Treatment	**03/06/2024**		**10/06/2024**		**17/06/2024**		**17/06/2024**		**24/06/2024**		**02/07/2024**		**10/07/2024**		**15/07/2024**		**22/07/2024**		**29/07/2024**	
Untreated	5.0	b	10.3	b	11.9	a	8.5	c	11.6	b	21.0	c	36.3	c	43.9	c	54.7	c	60.8	c
Velum Prime	6.1	a	11.1	a	11.9	a	9.5	b	13.7	a	29.0	b	46.4	b	54.0	b	65.6	b	72.2	b
Nemathorin	4.9	b	10.6	ab	11.9	a	10.7	a	13.7	a	34.2	a	57.9	a	66.4	a	80.3	a	92.5	a
LSD P=.05		0.71		0.62		0.33		0.96		1.22		3.39		5.07		4.02		4.82		5.22
Std Dev		1.51		1.32		0.70		2.04		2.61		7.23		10.81		8.56		10.27		11.11
CV		28.38		12.41		5.86		21.27		20.07		25.77		23.08		15.63		15.36		14.78

	Emergence (N°/5m)						Ground Cover (%)											
	03/06/2024		10/06/2024		17/06/2024		17/06/2024		24/06/2024		02/07/2024		10/07/2024		15/07/2024		22/07/2024		29/07/2024	
Maris Piper (U)	1.5	efg	9.8	gh	10.0	f	7.8	f-j	13.8	cde	22.5	f-j	38.8	efg	52.5	e-h	62.5	ghi	72.5	e-h
Maris Piper (V)	1.0	fg	10.0	fgh	10.0	f	8.5	e-i	15.0	bcd	32.5	c-f	48.8	cde	60.0	c-f	71.3	d-h	82.5	cde
Maris Piper (N)	0.5	fg	9.0	ghi	10.0	f	9.3	e-h	12.5	def	30.0	c-g	58.8	bcd	70.0	bc	78.8	b-e	97.5	abc
Elland (U)	0.3	fg	8.3	hi	10.3	ef	5.3	jk	7.3	hi	10.0	k	16.3	h	25.0	l	37.5	l	36.3	l
Elland (V)	2.3	ef	9.0	ghi	10.0	f	6.0	ij	8.5	ghi	12.5	jk	25.0	gh	26.3	l	47.5	jkl	45.0	kl
Elland (N)	1.8	efg	9.3	gh	9.8	fg	6.5	hij	7.8	ghi	15.0	ijk	27.5	gh	33.8	jkl	55.0	ijk	81.3	def
Eurostar (U)	9.8	cd	12.8	cd	13.0	c	15.0	ab	17.5	b	40.0	bc	70.0	ab	71.3	bc	77.5	b-f	83.8	b-e
Eurostar (V)	11.0	bcd	12.5	cd	12.8	cd	15.0	ab	21.3	a	50.0	ab	72.5	ab	71.3	bc	80.0	b-e	86.3	a-e
Eurostar (N)	9.8	cd	12.8	cd	12.8	cd	17.5	a	22.5	a	60.0	a	81.3	a	86.3	a	95.0	a	100.0	a
Buster (U)	0	g	1.5	k	8.0	i	3.0	k	5.5	i	12.5	jk	17.5	h	30.0	kl	45.0	kl	51.3	i-l
Buster (V)	0.8	fg	6.3	j	8.5	hi	5.0	jk	9.3	fgh	20.0	g-k	35.0	efg	51.3	f-i	62.5	ghi	72.5	e-h
Buster (N)	0	g	6.0	j	9.0	gh	6.0	ij	10.0	fgh	27.5	d-h	46.3	cde	63.8	cde	76.3	b-g	88.8	a-d
Amanda (U)	10.5	cd	12.0	de	13.0	c	11.3	cde	13.8	cde	22.5	f-j	37.5	efg	42.5	hij	51.3	i-l	60.0	h-k
Amanda (V)	10.5	cd	12.5	cd	12.8	cd	12.5	bcd	15.0	bcd	31.3	c-f	47.5	cde	50.0	f-i	63.8	f-i	66.3	f-i
Amanda (N)	10.8	cd	11.8	def	12.8	cd	13.8	bc	16.3	bc	36.3	cd	61.3	bc	68.8	bcd	81.3	a-e	88.8	a-d
Karelia (U)	11.8	abc	16.0	a	15.8	a	11.3	cde	12.5	def	17.5	h-k	30.0	fgh	40.0	ijk	47.5	jkl	57.5	h-k
Karelia (V)	13.3	a	15.3	ab	15.5	ab	11.3	cde	17.5	b	31.3	c-f	45.0	def	52.5	e-h	60.0	hij	63.8	ghi
Karelia (N)	9.5	d	14.3	abc	15.5	ab	13.8	bc	16.3	bc	38.8	c	67.5	ab	68.8	bcd	85.0	a-d	92.5	a-d
Paradox (U)	2.0	efg	9.3	gh	10.5	ef	6.8	hij	9.0	f-i	16.3	ijk	26.3	gh	32.5	jkl	46.3	jkl	46.3	jkl
Paradox (V)	3.3	e	10.5	efg	11.0	e	7.8	f-j	10.5	e-h	22.5	f-j	37.5	efg	46.3	ghi	53.8	ijk	63.8	ghi
Paradox (N)	1.0	fg	7.3	ij	9.8	fg	7.3	g-j	9.3	fgh	27.5	d-h	43.8	def	57.5	d-g	75.0	c-g	86.3	a-e
Olivia (U)	0	g	8.8	ghi	12.0	d	6.0	ij	11.3	efg	22.5	f-j	43.8	def	52.5	e-h	70.0	e-h	78.8	d-g
Olivia (V)	0	g	9.0	ghi	12.0	d	8.5	e-i	11.3	efg	31.3	c-f	57.5	bcd	68.8	bcd	77.5	b-f	91.3	a-d
Olivia (N)	0.5	fg	10.0	fgh	12.3	cd	10.0	d-g	13.8	cde	35.0	cde	68.8	ab	77.5	ab	90.0	ab	98.8	ab
Bruar (U)	9.5	d	14.0	bc	14.8	b	10.5	def	13.8	cde	25.0	e-i	46.3	cde	48.8	f-i	55.0	ijk	61.3	hij
Bruar (V)	13.0	ab	15.3	ab	15.0	ab	11.3	cde	15.0	bcd	30.0	c-g	48.8	cde	60.0	c-f	73.8	c-h	78.8	d-g
Bruar (N)	10.0	cd	15.3	ab	15.3	ab	12.5	bcd	15.0	bcd	37.5	cd	66.3	ab	71.3	bc	86.3	abc	98.8	ab
LSD P=.05		2.13		1.86		0.98		2.87		3.67		10.18		15.22		12.05		14.45		15.65
Standard Deviation		1.51		1.32		0.70		2.04		2.61		7.23		10.81		8.56		10.27		11.11
CV		28.38		12.41		5.86		21.27		20.07		25.77		23.08		15.63		15.36		14.78

Number of plants, stems, rots, dry matter, and density

The number of plants in each plot was a factor of the initial planting rate with the number of stems in each 3 m of drill length being dependent upon the planting density and the characteristics of the variety. There was no significant effect of Nemathorin or Velum Prime application on the number of plants. There was a significant difference between the number of stems on plants between the average of Velum Prime and Nemathorin treated plots, 34.1 and 30.7 stems respectively.

A small number of soft rots were present at harvest and at the time of grading. There was no overall significant effect of Nemathorin or Velum Prime treatment on the development of rots. The small number of rots recorded across different varieties and treatments were not considered to be of importance. The dry matter (and related assessment of density) was, as expected, found to vary significantly between varieties and not statistically affected by nematicide treatment.

Table 4 – Number of plants and stems at the end of the season, Dry matter content, soft rots and density.

Variety	Soft Rots 22/10/2024 N°/3m		Plants 03/10/2024 N°/3m		Stems 03/10/2024 N°/3m		Dry Matter 01/11/2024 %		Density 01/11/2024 1.065-1.110	
Maris Piper	0.2	ab	6.3	de	22.5	f	18.3	b	1.072	b
Elland	0.3	ab	6.2	e	16.0	g	17.1	d	1.066	c
Eurostar	0.2	ab	8.2	c	36.4	c	17.9	c	1.070	b
Buster	0.4	ab	5.8	e	27.0	ef	17.0	d	1.065	c
Amanda	0	b	8.3	c	34.0	cd	19.8	a	1.079	a
Karelia	0	b	10.4	a	43.8	a	17.0	d	1.065	c
Paradox	0.7	a	6.8	d	38.2	bc	17.9	c	1.070	b
Olivia	0	b	8.0	c	41.8	ab	17.1	d	1.066	c
Bruar	0	b	9.3	b	30.8	de	18.2	bc	1.072	b
LSD P=.05		0.56		0.56		4.64		0.42		0.002
Standard Deviation		0.68		0.69		5.71		0.52		0.002
CV		351.36		9.01		17.70		2.90		0.225

Treatment	Soft Rots 22/10/2024 N°/3m		Plants 03/10/2024 N°/3m		Stems 03/10/2024 N°/3m		Dry Matter 01/11/2024 %		Density 01/11/2024 1.065-1.110	
Untreated	0	a	7.7	a	32.0	ab	17.8	ab	1.069	ab
Velum Prime	0.3	a	7.7	a	34.1	a	18.0	a	1.070	a
Nemathorin	0.3	a	7.7	a	30.7	b	17.6	b	1.069	b
LSD P=.05		0.32		0.33		2.68		0.24		0.001
Standard Deviation		0.68		0.69		5.71		0.52		0.002
CV		351.36		9.01		17.70		2.90		0.225

	Soft Rots 22/10/2024 N°/3m		Plants 03/10/2024 N°/3m		Stems 03/10/2024 N°/3m		Dry Matter 01/11/2024 %		Density 01/11/2024 1.065-1.110	
Maris Piper (U)	0	c	6.3	ghi	22.0	mno	18.6	c	1.074	d
Maris Piper (V)	0.5	bc	6.3	ghi	22.0	mno	18.2	cd	1.072	de
Maris Piper (N)	0	c	6.5	ghi	23.5	lmn	18.2	cd	1.071	def
Elland (U)	0	c	6.5	ghi	14.3	o	17.0	g	1.065	i
Elland (V)	0	c	6.0	hi	19.0	no	17.2	g	1.067	hi
Elland (N)	1.0	ab	6.0	hi	14.8	o	17.2	g	1.067	hi
Eurostar (U)	0	c	8.0	e	36.0	c-i	17.4	efg	1.068	f-i
Eurostar (V)	0	c	8.5	de	38.8	a-f	18.6	c	1.074	cd
Eurostar (N)	0.5	bc	8.0	e	34.5	e-j	17.6	d-g	1.069	e-h
Buster (U)	0	c	5.8	i	26.5	j-n	17.0	g	1.065	i
Buster (V)	0.5	bc	5.8	i	29.0	i-m	17.0	g	1.065	i
Buster (N)	0.8	bc	6.0	hi	25.5	k-n	17.0	g	1.065	i
Amanda (U)	0	c	8.5	de	36.5	b-i	19.6	b	1.078	b
Amanda (V)	0	c	8.5	de	35.3	d-i	20.4	a	1.082	a
Amanda (N)	0	c	7.8	ef	30.3	g-l	19.4	b	1.077	bc
Karelia (U)	0	c	10.8	a	46.8	a	17.0	g	1.065	i
Karelia (V)	0	c	10.3	ab	44.3	ab	17.0	g	1.065	i
Karelia (N)	0	c	10.3	ab	40.5	a-e	17.0	g	1.065	i
Paradox (U)	0.3	bc	6.8	gh	37.3	b-h	18.1	cde	1.072	de
Paradox (V)	1.8	a	6.8	gh	43.3	a-d	18.2	cd	1.071	def
Paradox (N)	0	c	7.0	fg	34.0	e-j	17.3	fg	1.068	ghi
Olivia (U)	0	c	8.0	e	38.3	b-g	17.1	g	1.066	hi
Olivia (V)	0	c	8.0	e	43.5	abc	17.3	fg	1.067	hi
Olivia (N)	0	c	8.0	e	43.5	abc	17.0	g	1.065	i
Bruar (U)	0	c	9.0	cd	30.8	f-l	18.4	c	1.073	d
Bruar (V)	0	c	9.3	cd	31.8	f-k	18.2	cd	1.072	de
Bruar (N)	0	c	9.5	bc	29.8	h-m	18.0	c-f	1.071	d-g
LSD P=.05		0.96		0.98		8.04		0.73		0.003
Standard Deviation		0.68		0.69		5.71		0.52		0.002
CV		351.36		9.01		17.70		2.90		0.225

Internal Defects – Spraing, Hollow Heart, and Internal Rust Spot (IRS)

No spraing symptoms were observed in any of the varieties tested this year. There were no statistically significant differences between incidence rate of Internal Rust Spot or Hollow heart by treatment. This suggests differences are more likely due to individual variety susceptibilities. Elland had the highest percentage incidence of IRS with Maris Piper second (Figure 2). Maris Piper had the highest percentage incidence of hollow heart with Elland following second highest.

	Spraing 11/11/2024 %		IRS 11/11/2024 %		Hollow Heart 11/11/2024 %	
Maris Piper	0	na	1.7	ab	1.7	a
Elland	0	na	2.3	a	1.0	ab
Eurostar	0	na	1.3	abc	0	b
Buster	0	na	0.3	bc	0	b
Amanda	0	na	0	c	0	b
Karelia	0	na	0.3	bc	0	b
Paradox	0	na	0.7	bc	0.7	ab
Olivia	0	na	0	c	0	b
Bruar	0	na	1.0	abc	0	b
LSD P=.05		.		1.34		1.20
Standard Deviation		0		1.59		1.43
CV		0		186.93		386.70

	Spraing 11/11/2024 %		IRS 11/11/2024 %		Hollow Heart 11/11/2024 %	
Untreated	0		0.6	a	0.7	a
Velum Prime	0		0.8	a	0.1	a
Nemathorin	0		1.2	a	0.3	a
LSD P=.05		.		0.77		0.69
Standard Deviation		0		1.59		1.43
CV		0		186.93		386.70

	Spraing 11/11/2024 %		IRS 11/11/2024 %		Hollow Heart 11/11/2024 %	
Maris Piper (U)	0	1.0	bc	5.0	a	
Maris Piper (V)	0	1.0	bc	0	b	
Maris Piper (N)	0	3.0	ab	0	b	
Elland (U)	0	0	c	0	b	
Elland (V)	0	4.0	a	1.0	b	
Elland (N)	0	3.0	ab	2.0	b	
Eurostar (U)	0	1.0	bc	0	b	
Eurostar (V)	0	1.0	bc	0	b	
Eurostar (N)	0	2.0	abc	0	b	
Buster (U)	0	0	c	0	b	
Buster (V)	0	0	c	0	b	
Buster (N)	0	1.0	bc	0	b	
Amanda (U)	0	0	c	0	b	
Amanda (V)	0	0	c	0	b	
Amanda (N)	0	0	c	0	b	
Karelia (U)	0	1.0	bc	0	b	
Karelia (V)	0	0	c	0	b	
Karelia (N)	0	0	c	0	b	
Paradox (U)	0	0	c	1.0	b	
Paradox (V)	0	0	c	0	b	
Paradox (N)	0	2.0	abc	1.0	b	
Olivia (U)	0	0	c	0	b	
Olivia (V)	0	0	c	0	b	
Olivia (N)	0	0	c	0	b	
Bruar (U)	0	2.0	abc	0	b	
Bruar (V)	0	1.0	bc	0	b	
Bruar (N)	0	0	c	0	b	
LSD P=.05	.	2.31		2.08		
Standard Deviation	0	1.59		1.43		
CV	0	186.93		386.70		

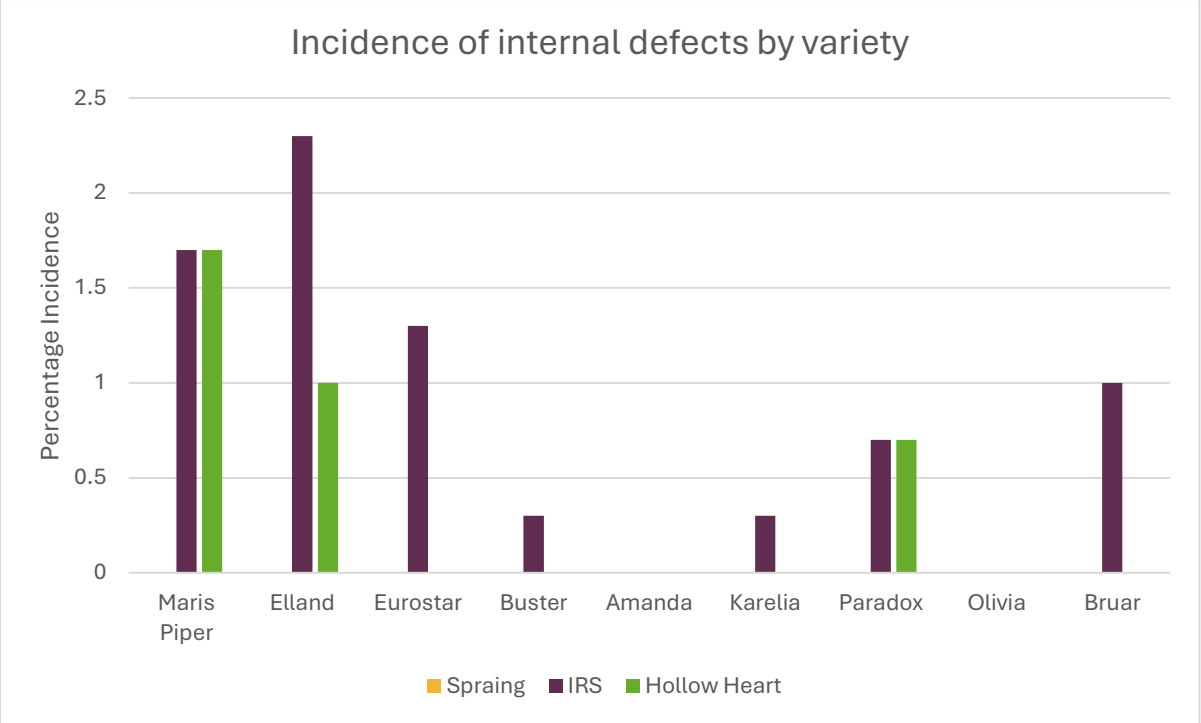

Figure 2 - Percentage occurrence of internal defects (Spraing, Internal rust spot, and hollow heart) by variety in 50 tuber samples (Average observed across untreated, Velum Prime, and Nemathorin treated plots).

.

Initial PCN Population (Pi) and Population After Harvest (Pf)

The initial population (Pi) was determined for each plot and *G. pallida* was the only species detected. Samples to determine Pi were taken on 22/05/24. There was variation across plots however this field was classified as having a moderate-high PCN population with an average of 39.6 eggs/juveniles g/soil across the plots tested. The lowest average Pi was recorded in the Olivia plots (16.5 eggs/juveniles g/soil each) and the highest in Eurostar plots (73.3 eggs/juveniles g/soil).

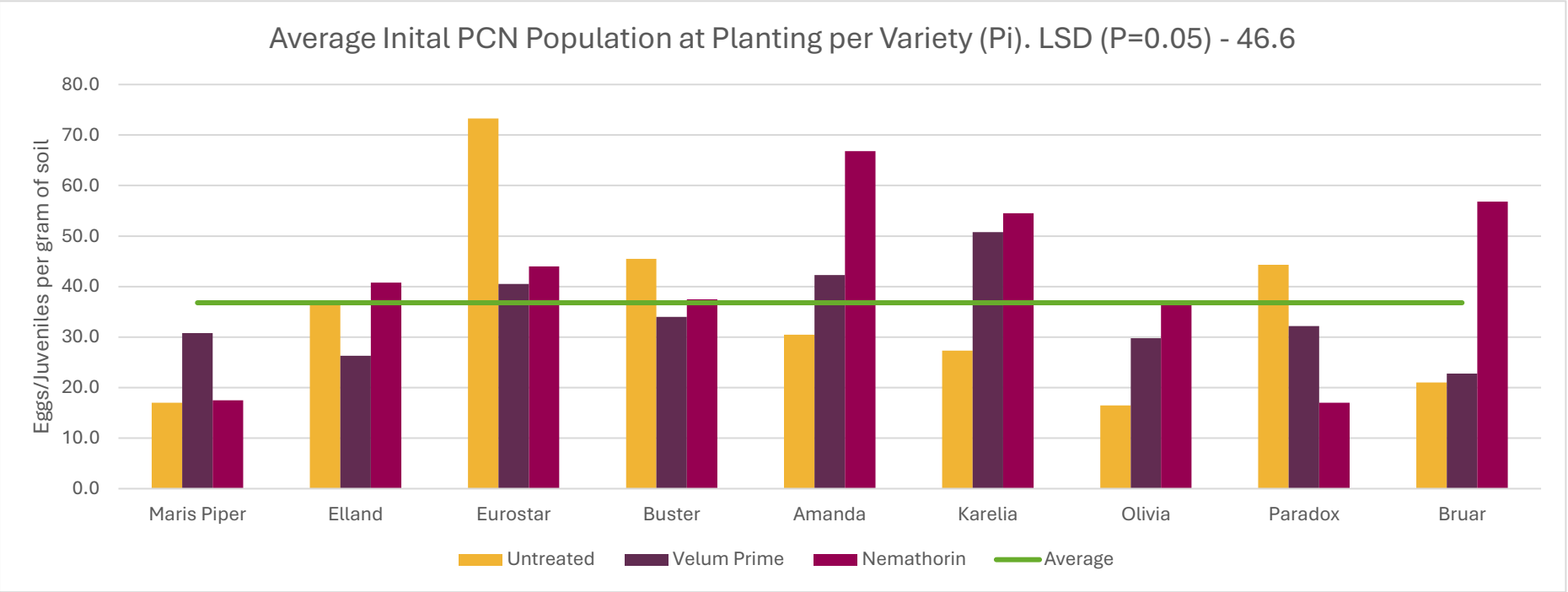

Figure 3 - PCN population (eggs/juveniles per gram of soil) (Pi) at planting for each variety by treatment. Pi represented as averages across four replicate plots. Green bar – Average number of eggs/juveniles per gram across field site (36.8 eggs/juveniles g/soil). LSD – Least significant difference.

Table 5 - Analysis of Initial PCN population (Pi) (22/05/2024) and after harvest (Pf) (03/10/2024) expressed as eggs/juveniles and viable cysts per gram of soil, per 400 g of soil, and Pf/Pi ratios.

	Viable Cysts						Eggs/Juveniles					
	Pi /400g soil		Pi /g soil		Pf /400g soil		Pf /g soil		Pf/Pi /400g soil	Pf/Pi /g soil	Pi /g soil		Pf /g soil		Pf/Pi /g soil
Maris Piper	30.7	ab	0.08	ab	250.9	a	0.63	a	8.17	7.84	21.8	a	434.1	a	19.91
Elland	32.5	ab	0.08	ab	17.5	b	0.04	b	0.54	0.55	34.7	a	18.9	b	0.54
Eurostar	52.5	a	0.13	a	16.6	b	0.04	b	0.32	0.32	52.6	a	22.3	b	0.42
Buster	41.8	ab	0.10	ab	18.6	b	0.05	b	0.44	0.46	39.0	a	15.6	b	0.40
Amanda	51.9	a	0.13	a	26.5	b	0.07	b	0.51	0.51	46.5	a	13.9	b	0.30
Karelia	48.9	a	0.12	a	31.8	b	0.08	b	0.65	0.66	44.2	a	16.9	b	0.38
Paradox	30.7	ab	0.08	ab	41.8	b	0.10	b	1.36	1.31	31.2	a	30.4	b	0.97
Olivia	19.7	b	0.05	b	25.9	b	0.06	b	1.31	1.30	27.6	a	20.3	b	0.73
Bruar	27.4	ab	0.07	ab	37.8	b	0.09	b	1.38	1.35	33.5	a	36.8	b	1.10
LSD P=.05		26.91		0.07		34.31		0.09	.	.		31.34		68.11	.
Standard Deviation		33.10		0.08		42.22		0.11	.	.		38.56		83.79	.
CV		88.65		88.65		81.28		81.28	.	.		104.86		123.82	.

	Viable Cysts						Eggs/Juveniles					
	Pi /400g soil		Pi /g soil		Pf /400g soil		Pf /g soil		Pf/Pi /400g soil	Pf/Pi /g soil	Pi /g soil		Pf /g soil		Pf/Pi /g soil
Untreated	39.3	a	0.10	a	53.9	a	0.13	a	1.37	1.35	34.7	a	71.6	a	2.06
Velum Prime	36.9	a	0.09	a	53.3	a	0.13	a	1.44	1.48	34.4	a	70.6	a	2.05
Nemathorin	35.8	a	0.09	a	48.7	a	0.12	a	1.36	1.35	41.3	a	60.8	a	1.47
LSD P=.05		15.53		0.04		19.81		0.05				18.09		39.33	
Standard Deviation		33.10		0.08		42.22		0.11				38.56		83.79	
CV		88.65		88.65		81.28		81.28				104.86		123.82	

	Viable Cysts								Eggs/Juveniles				
	Pi /400g soil		Pi /g soil		Pf /400g soil		Pf /g soil		Pf/Pi /400g soil	Pf/Pi /g soil	Pi /g soil		Pf /g soil		Pf/Pi /g soil
Maris Piper (U)	36.8	b	0.09	ab	278.0	a	0.70	a	7.55	7.72	17.0	ab	478.4	a	28.14
Maris Piper (V)	29.8	ab	0.07	ab	243.5	a	0.61	a	8.17	8.70	30.8	ab	435.1	a	14.13
Maris Piper (N)	25.5	b	0.06	ab	231.3	a	0.58	a	9.07	9.64	17.5	ab	388.7	a	22.21
Elland (U)	34.0	ab	0.09	ab	20.5	b	0.05	b	0.60	0.57	37.0	ab	13.1	b	0.35
Elland (V)	27.5	ab	0.07	ab	17.5	b	0.04	b	0.64	0.63	26.3	ab	24.4	b	0.93
Elland (N)	36.0	ab	0.09	ab	14.5	b	0.04	b	0.40	0.40	40.8	ab	19.3	b	0.47
Eurostar (U)	68.5	a	0.17	a	13.3	b	0.03	b	0.19	0.19	73.3	a	24.5	b	0.33
Eurostar (V)	50.0	ab	0.13	ab	14.3	b	0.04	b	0.29	0.27	40.5	ab	16.8	b	0.41
Eurostar (N)	39.0	ab	0.10	ab	22.3	b	0.06	b	0.57	0.56	44.0	ab	25.7	b	0.58
Buster (U)	38.0	ab	0.10	ab	15.3	b	0.04	b	0.40	0.38	45.5	ab	8.5	b	0.19
Buster (V)	39.0	ab	0.10	ab	23.3	b	0.06	b	0.60	0.58	34.0	ab	19.3	b	0.57
Buster (N)	48.5	ab	0.12	ab	17.3	b	0.04	b	0.36	0.36	37.5	ab	18.9	b	0.50
Amanda (U)	49.8	ab	0.12	ab	15.5	b	0.04	b	0.31	0.32	30.5	ab	16.9	b	0.55
Amanda (V)	54.5	ab	0.14	ab	31.5	b	0.08	b	0.58	0.56	42.3	ab	14.1	b	0.33
Amanda (N)	51.5	ab	0.13	ab	32.5	b	0.08	b	0.63	0.63	66.8	ab	10.6	b	0.16
Karelia (U)	33.3	ab	0.08	ab	40.0	b	0.10	b	1.20	1.25	27.3	ab	11.3	b	0.41
Karelia (V)	60.8	ab	0.15	ab	32.8	b	0.08	b	0.54	0.55	50.8	ab	23.8	b	0.47
Karelia (N)	52.8	ab	0.13	ab	22.8	b	0.06	b	0.43	0.44	54.5	ab	15.5	b	0.28
Paradox (U)	51.5	ab	0.13	ab	38.5	b	0.10	b	0.75	0.74	44.3	ab	28.1	b	0.63
Paradox (V)	26.0	ab	0.07	ab	46.8	b	0.12	b	1.80	1.67	32.3	ab	44.1	b	1.37
Paradox (N)	14.5	b	0.04	b	40.3	b	0.10	b	2.78	2.52	17.0	b	18.9	b	1.11
Olivia (U)	17.3	b	0.04	b	21.3	b	0.05	b	1.23	1.33	16.5	b	20.3	b	1.23
Olivia (V)	23.0	ab	0.06	ab	36.5	b	0.09	b	1.59	1.52	29.8	ab	19.9	b	0.67
Olivia (N)	18.8	ab	0.05	b	20.0	b	0.05	b	1.06	1.00	36.5	b	20.6	b	0.56
Bruar (U)	25.0	ab	0.06	ab	42.5	b	0.11	b	1.70	1.77	21.0	ab	43.7	b	2.08
Bruar (V)	21.5	ab	0.05	b	33.8	b	0.08	b	1.57	1.69	22.8	b	38.1	b	1.67
Bruar (N)	35.8	ab	0.09	ab	37.3	b	0.09	b	1.04	1.03	56.8	ab	28.7	b	0.51
LSD P=.05		54.28		0.12		59.43		0.15	.	.		46.60		117.97	.
Standard Deviation		38.56		0.08		42.22		0.11	.	.		33.10		83.79	.
CV		104.86		88.65		81.28		81.28	.	.		88.65		123.82	.

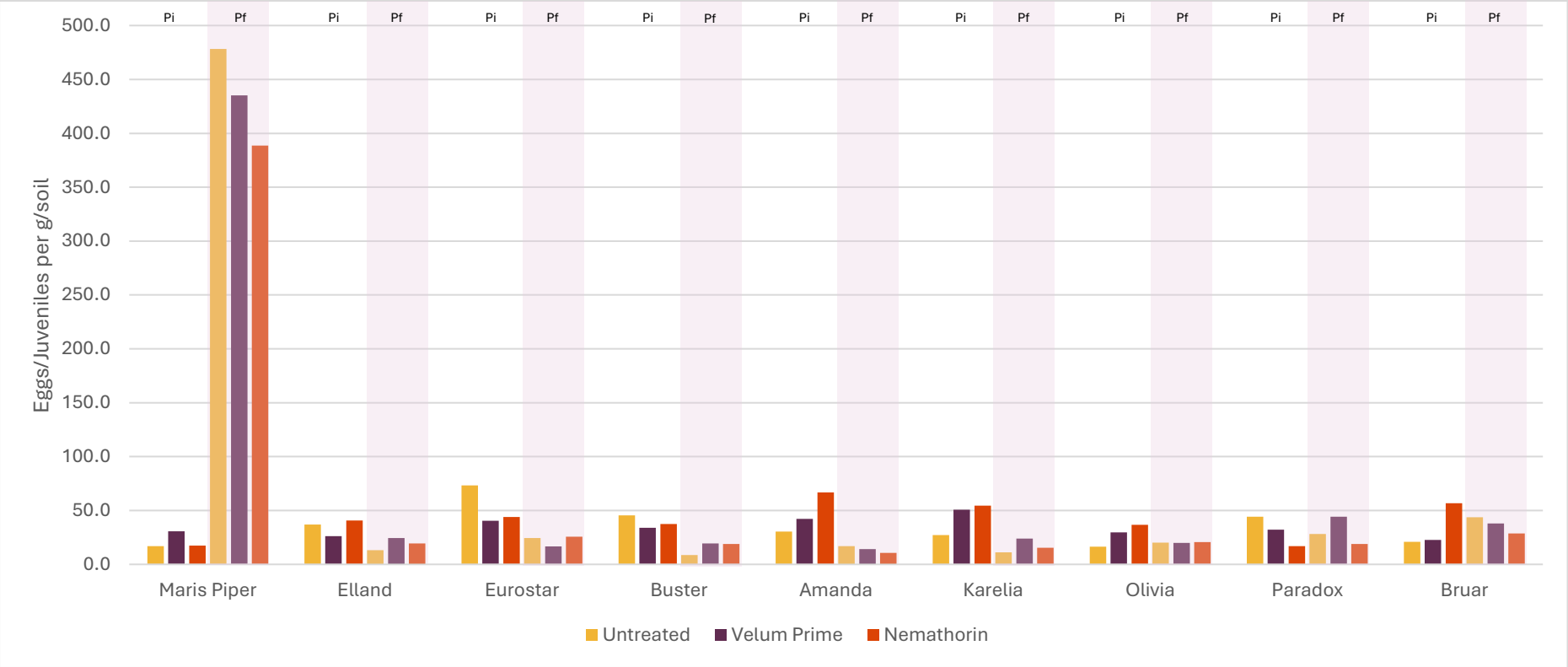

Figure 4 - Pre-plant (Pi) versus Post-harvest (Pf - highlighted in transparent purple boxes) PCN populations (eggs/juveniles per gram of soil) for varieties treated with Nemathorin, Velum Prime, or untreated replicates.

A Pf/Pi ratio is used to compare the change in PCN population between pre-planting and post-harvest. A Pf/Pi ratio of less than 1 indicates that a variety is highly resistant against PCN and is reducing the PCN population present in the field. Maris piper, as a susceptible variety, has increased the PF/Pi ratio to between 14-28 depending on treatment demonstrating the PCN population being increased by 21 times on average across the treatments. Elland, Eurostar, Buster, Amanda, and Karelia all had a Pf/Pi ratio under 1, meaning they reduced the PCN population present in the plots. These varieties all have a resistance score of 9. Olivia has a resistance score of 8 for *G. pallida* which was reflected when combined with both nematicide treatments giving Pi/Pf ratios under 1. Olivia did give a Pf/Pi ratio of 1.23 in the untreated plots due to a marginal increase in PCN population by 3.8 eggs/juveniles per gram of soil. Paradox and Bruar have resistance scores of 7 and 6 respectively, so it was expected that these would have Pf/Pi ratios over 1. It is interesting to consider the difference in ratios between these varieties and Maris Piper; however, this demonstrates that using varieties which are partially resistant to PCN is a better management practice than growing a susceptible variety in a field with PCN.

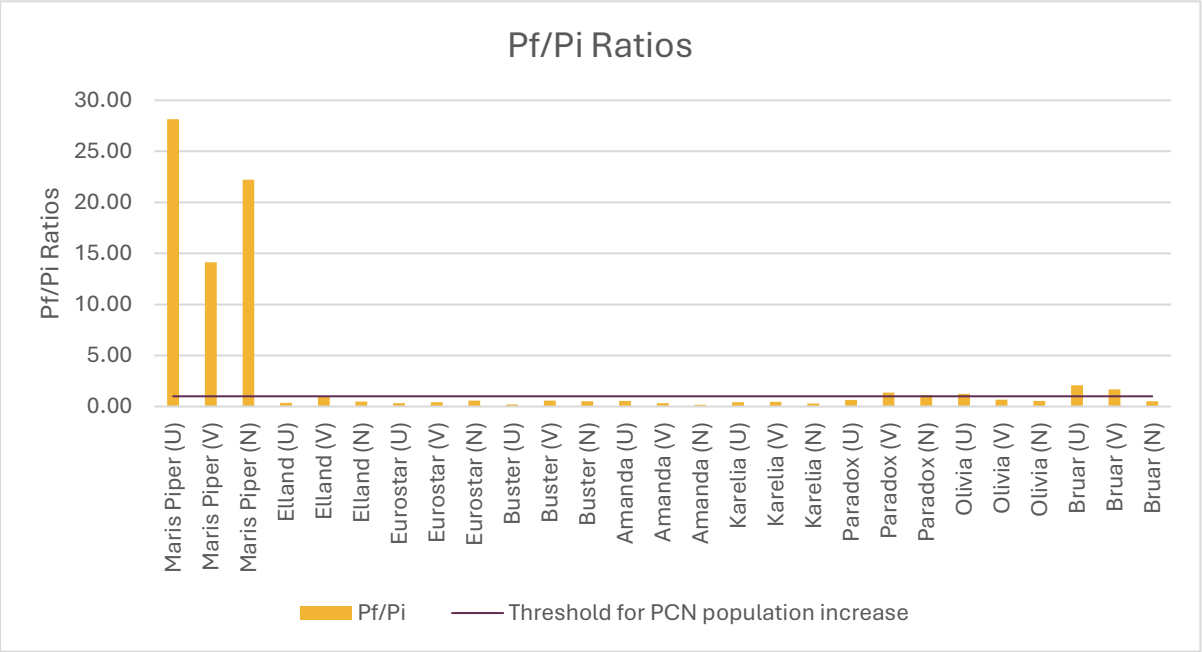

Figure 5 - Pre-plant (Pi) and Post-harvest (Pf) ratios by variety and treatment. Purple line indicates the point (1) at which a Pf/Pi ratio indicates an increase in PCN population.

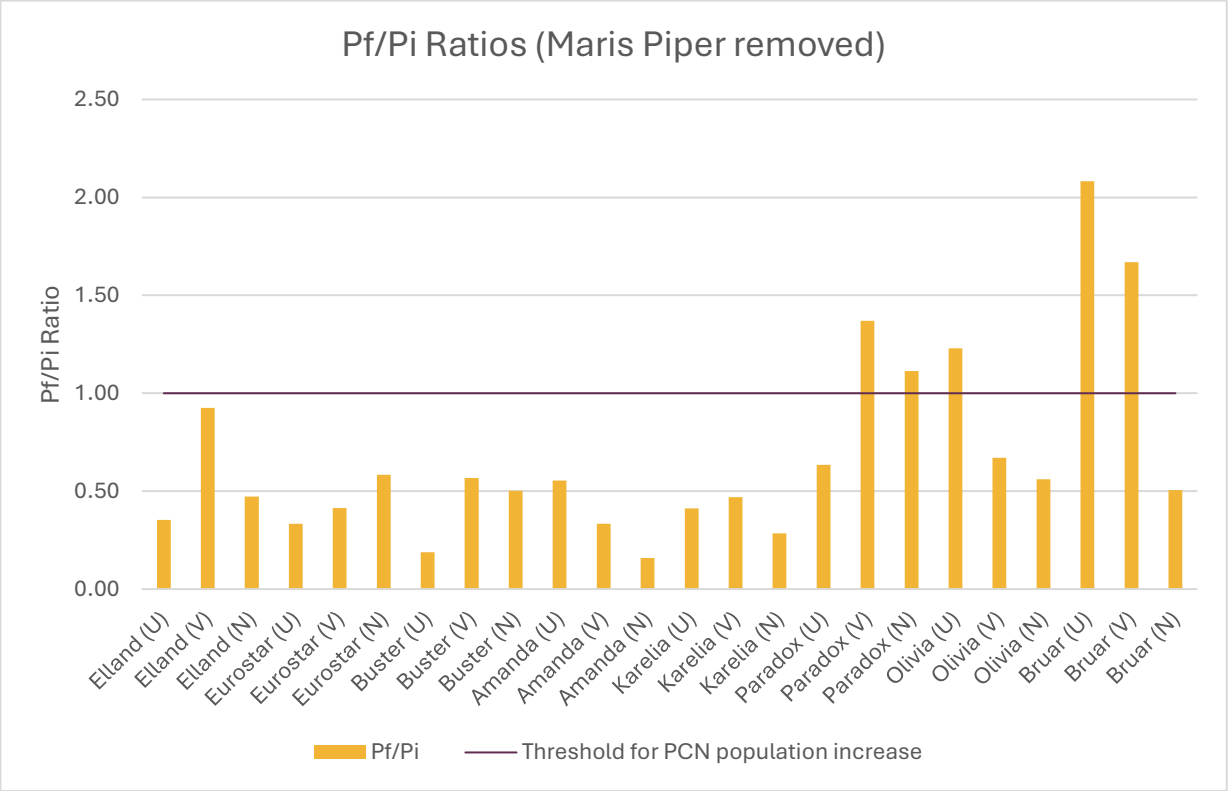

Figure 6 - Pre-plant (Pi) and Post-harvest (Pf) ratios by variety and treatment. Data identical to figure 4 however Maris Piper has been omitted to visualise the other Pf/Pi ratios easier. Purple line indicates the point (1) at which a Pf/Pi ratio indicates an increase in PCN population.

Yield and Tuber Numbers

Table 6 - Total Yield (in tonnes per hectare) split by 5 mm size fractions by variety and treatments.

Yield (T/Ha) by variety																								
	<25mm		25-30mm		30-35mm		35-40mm		40-45mm		45-50mm		50-55mm		55-60mm		60-65mm		65-70mm		70-75mm		75-80mm		>80mm	
Maris Piper	0.07	ab	0.15	ab	0.27	a	0.44	bc	1.13	abc	1.85	bc	4.13	b	5.25	cd	7.35	bcd	8.08	ab	7.97	bc	4.65	bc	3.13	efg
Elland	0.02	c	0.06	c	0.22	a	0.29	c	0.74	cd	0.79	e	1.67	e	2.25	e	3.97	e	5.71	bc	5.27	cd	6.37	ab	12.90	a
Eurostar	0.07	ab	0.16	ab	0.34	a	0.61	ab	0.87	bcd	2.44	ab	3.98	b	6.23	bc	8.51	b	10.23	a	7.46	bcd	4.79	bc	4.31	def
Buster	0.05	abc	0.10	bc	0.23	a	0.48	bc	1.08	bcd	1.68	bc	2.59	cde	5.27	cd	6.24	cd	8.98	a	7.97	bc	6.46	ab	5.71	cde
Amanda	0.04	bc	0.12	abc	0.33	a	0.63	ab	1.24	ab	1.92	bc	4.34	b	7.15	b	8.31	bc	9.25	a	6.07	bcd	3.78	bc	1.60	fg
Karelia	0.03	bc	0.07	c	0.23	a	0.52	abc	1.05	bcd	1.80	bc	3.47	bc	5.74	bc	7.82	bc	10.44	a	8.88	ab	6.40	ab	7.19	bcd
Paradox	0.07	ab	0.17	a	0.21	a	0.59	ab	1.11	a-d	1.57	cd	3.22	bcd	4.68	cd	5.46	de	5.27	c	6.07	bcd	4.76	bc	8.84	bc
Olivia	0.10	a	0.18	a	0.27	a	0.74	a	1.54	a	3.03	a	5.80	a	9.80	a	13.00	a	10.10	a	5.01	d	1.94	c	0.90	g
Bruar	0.01	c	0.07	c	0.20	a	0.31	c	0.68	d	0.88	de	2.06	de	4.03	d	6.46	bcd	9.43	a	10.81	a	7.96	a	10.51	ab
LSD P=.05	0.05		0.07		0.14		0.24		0.44		0.76		1.19		1.65		2.17		2.69		2.83		2.95		3.37	
Std Dev	0.06		0.08		0.18		0.29		0.54		0.94		1.46		2.03		2.67		3.31		3.49		3.63		4.15	
CV	110.96		69.72		69.09		56.95		51.96		52.86		42.07		36.24		35.76		38.47		47.90		69.41		67.77	

Yield (T/Ha) by treatment																								
	<25mm		25-30mm		30-35mm		35-40mm		40-45mm		45-50mm		50-55mm		55-60mm		60-65mm		65-70mm		70-75mm		75-80mm		>80mm	
Untreated	0.06	a	0.14	a	0.30	a	0.57	a	1.12	a	1.98	a	3.77	a	5.54	a	6.80	b	7.96	a	5.72	b	4.67	a	3.70	b
Velum Prime	0.05	ab	0.10	b	0.22	a	0.49	a	1.01	a	1.94	a	3.59	ab	6.06	a	8.92	a	8.99	a	7.46	a	5.14	a	4.71	b
Nemathorin	0.04	b	0.12	ab	0.25	a	0.47	a	1.01	a	1.40	b	3.06	b	5.20	a	6.65	b	8.88	a	8.64	a	5.89	a	9.96	a
LSD P=.05	0.03		0.04		0.08		0.14		0.26		0.44		0.69		0.95		1.25		1.55		1.64		1.70		1.95	
Std Dev	0.06		0.08		0.18		0.29		0.54		0.94		1.46		2.03		2.67		3.31		3.49		3.63		4.15	
CV	110.96		69.72		69.09		56.95		51.96		52.86		42.07		36.24		35.76		38.47		47.90		69.41		67.77	

Yield (T/Ha) by treatment and variety																														
	<25mm		25-30mm		30-35mm		35-40mm		40-45mm		45-50mm		50-55mm		55-60mm		60-65mm		65-70mm		70-75mm		75-80mm		>80mm	
Maris Piper (U)	0.07	a-e	0.19	abc	0.29	abc	0.48	c-f	1.36	a-e	2.50	a-e	5.15	abc	5.95	d-g	6.52	e-i	7.49	b-f	5.91	b-g	3.18	d-g	1.34	gh
Maris Piper (V)	0.10	abc	0.08	c-g	0.23	abc	0.37	ef	0.93	c-g	1.47	d-i	3.48	c-h	4.75	e-i	8.86	c-g	8.69	a-f	7.71	b-g	5.53	a-f	3.70	e-h
Maris Piper (N)	0.03	cde	0.18	a-d	0.30	abc	0.46	c-f	1.11	b-g	1.58	c-i	3.76	c-f	5.04	e-i	6.66	e-i	8.06	a-f	10.29	abc	5.25	a-g	4.35	e-h
Elland (U)	0.00	e	0.06	g	0.19	bc	0.11	f	0.75	efg	0.93	ghi	1.24	i	1.36	j	2.28	j	4.84	ef	3.96	fg	8.86	abc	8.57	cde
Elland (V)	0.01	e	0.05	g	0.15	bc	0.42	c-f	0.69	efg	0.86	ghi	1.60	hi	2.77	hij	5.93	g-j	6.12	c-f	6.48	b-g	4.52	c-g	12.55	abc
Elland (N)	0.04	b-e	0.08	c-g	0.33	abc	0.33	ef	0.77	d-g	0.59	hi	2.17	f-i	2.63	ij	3.71	ij	6.16	c-f	5.38	c-g	5.72	a-f	17.59	a
Eurostar (U)	0.09	a-d	0.13	b-g	0.39	ab	0.83	abc	0.56	fg	3.04	ab	2.99	d-i	6.44	def	7.80	d-h	7.95	a-f	7.38	b-g	5.98	a-f	4.43	e-h
Eurostar (V)	0.07	a-e	0.14	b-g	0.26	abc	0.53	b-e	0.90	c-g	2.45	a-e	4.53	a-e	6.68	c-f	10.76	a-d	12.37	a	7.48	b-g	2.44	efg	2.24	fgh
Eurostar (N)	0.06	a-e	0.22	ab	0.37	abc	0.48	c-f	1.15	b-g	1.82	b-h	4.42	b-e	5.58	d-h	6.97	e-i	10.37	abc	7.52	b-g	5.95	a-f	6.26	d-g
Buster (U)	0.11	ab	0.14	b-g	0.35	abc	0.58	b-e	1.84	ab	2.26	a-f	4.08	b-f	6.17	d-g	6.43	f-i	8.06	a-f	4.76	d-g	1.37	fg	1.90	gh
Buster (V)	0.03	b-e	0.09	c-g	0.14	c	0.41	def	0.68	efg	1.39	e-i	2.07	f-i	5.56	d-h	6.86	e-i	9.29	a-f	9.22	a-e	7.97	a-d	4.61	e-h
Buster (N)	0.02	de	0.06	fg	0.22	abc	0.46	c-f	0.72	efg	1.40	e-i	1.63	ghi	4.07	f-j	5.42	g-j	9.60	a-d	9.94	abc	10.04	a	10.62	bcd
Amanda (U)	0.07	a-e	0.12	b-g	0.44	a	1.02	a	1.22	b-g	2.77	a-d	4.95	a-d	7.14	b-e	8.74	c-g	6.08	c-f	4.43	efg	3.89	c-g	0.82	gh
Amanda (V)	0.02	de	0.18	a-e	0.36	abc	0.41	def	1.41	a-e	1.80	b-h	4.41	b-e	8.06	a-d	10.24	b-e	9.93	abc	5.99	b-g	2.66	efg	0.00	h
Amanda (N)	0.03	b-e	0.05	g	0.20	abc	0.45	c-f	1.08	b-g	1.19	e-i	3.66	c-g	6.27	d-g	5.95	g-j	11.73	ab	7.78	b-g	4.79	b-g	3.99	e-h
Karelia (U)	0.03	b-e	0.07	c-g	0.27	abc	0.49	c-f	0.71	efg	1.63	c-i	2.90	d-i	5.46	d-i	7.13	d-i	12.28	a	8.93	a-e	4.73	b-g	3.75	e-h
Karelia (V)	0.04	b-e	0.07	d-g	0.26	abc	0.70	a-e	1.53	a-d	2.80	abc	5.32	abc	7.27	b-e	9.96	b-f	9.34	a-e	9.42	a-d	4.63	c-g	0.64	gh
Karelia (N)	0.02	de	0.07	efg	0.17	bc	0.37	ef	0.92	c-g	0.96	f-i	2.21	f-i	4.49	e-i	6.38	f-i	9.70	a-d	8.28	b-f	9.83	ab	17.18	a
Paradox (U)	0.11	ab	0.28	a	0.29	abc	0.83	abc	1.61	abc	1.44	e-i	3.95	c-f	4.06	f-j	4.89	hij	4.63	f	3.16	g	3.87	c-g	4.12	e-h
Paradox (V)	0.06	a-e	0.11	b-g	0.16	bc	0.53	b-e	0.88	c-g	1.97	b-g	2.78	e-i	4.89	e-i	5.64	g-j	5.17	def	5.90	b-g	6.59	a-e	9.29	cde
Paradox (N)	0.03	b-e	0.13	b-g	0.18	bc	0.41	def	0.82	d-g	1.29	e-i	2.92	d-i	5.10	e-i	5.85	g-j	6.01	c-f	9.14	a-e	3.81	c-g	13.11	abc
Olivia (U)	0.08	a-e	0.18	a-f	0.28	abc	0.54	b-e	1.25	b-g	2.76	a-d	6.56	a	9.84	ab	12.81	ab	9.90	abc	4.32	efg	0.34	g	0.32	h
Olivia (V)	0.12	a	0.08	c-g	0.27	abc	0.91	ab	1.31	a-f	3.36	a	6.11	ab	9.42	abc	14.30	a	11.29	ab	4.64	d-g	3.38	d-g	1.31	gh
Olivia (N)	0.09	a-d	0.28	a	0.28	abc	0.79	a-d	2.07	a	2.98	ab	4.73	a-e	10.15	a	11.88	abc	9.13	a-f	6.06	b-g	2.09	efg	1.09	gh
Bruar (U)	0.01	e	0.12	b-g	0.20	abc	0.29	ef	0.78	d-g	0.47	i	2.13	f-i	3.48	g-j	4.64	hij	10.42	abc	8.67	a-f	9.79	ab	8.03	c-f
Bruar (V)	0.02	de	0.06	g	0.15	bc	0.11	f	0.76	efg	1.39	e-i	2.02	f-i	5.17	e-i	7.73	d-h	8.68	a-f	10.35	ab	8.58	abc	8.07	c-f
Bruar (N)	0.02	de	0.05	g	0.24	abc	0.53	b-e	0.49	g	0.79	ghi	2.04	f-i	3.44	g-j	7.02	d-i	9.19	a-f	13.42	a	5.52	a-f	15.44	ab
LSD P=.05	0.08		0.12		0.25		0.41		0.77		1.32		2.06		2.86		3.75		4.66		4.91		5.11		5.84	
Std Dev	0.06		0.08		0.18		0.29		0.54		0.94		1.46		2.03		2.67		3.31		3.49		3.63		4.15	
CV	110.96		69.72		69.09		56.95		51.96		52.86		42.07		36.24		35.76		38.47		47.90		69.41		67.77	

Below the yield results have been split into marketable fractions: total (T/Ha), 45-65 mm and >65 mm (Bakers).

Marketable yield fractions by variety and treatment												
	Total		45-65mm		>65mm			Total		45-65mm		>65mm	
Maris Piper	44.46	bc	18.57	bc	23.82	cde	Untreated	42.34	b	18.10	b	22.05	c
Elland	40.25	c	8.68	e	30.25	bc	Velum Prime	48.68	a	20.51	a	26.31	b
Eurostar	49.99	ab	21.15	b	26.78	bcd	Nemathorin	51.57	a	16.30	b	33.37	a
Buster	46.83	abc	15.77	cd	29.12	bc	LSD P=.05	4.31		1.86		4.08	
Amanda	44.76	bc	21.72	b	20.69	de	Std Dev	9.19		3.97		8.70	
Karelia	53.63	a	18.83	bc	32.90	ab	CV	19.34		21.71		31.94	
Paradox	41.99	c	14.92	d	24.93	cde							
Olivia	52.42	a	31.63	a	17.95	e							
Bruar	53.42	a	13.44	d	38.72	a							
LSD P=.05	7.47		3.23		7.07								
Std Dev	9.19		3.97		8.70								
CV	19.34		21.71		31.94								

Marketable yield fractions by variety and treatment						
	Total		45-65mm		>65mm	
Maris Piper (U)	40.41	efg	20.13	c-f	17.90	g-j
Maris Piper (V)	45.90	b-g	18.56	e-h	25.62	d-j
Maris Piper (N)	47.06	b-f	17.04	f-i	27.94	d-i
Elland (U)	33.14	g	5.81	m	26.23	d-j
Elland (V)	42.14	d-g	11.16	j-m	29.67	c-g
Elland (N)	45.48	b-g	9.09	lm	34.85	a-e
Eurostar (U)	48.01	a-f	20.27	c-f	25.74	d-j
Eurostar (V)	50.83	a-f	24.41	bcd	24.53	e-j
Eurostar (N)	51.14	a-e	18.79	e-h	30.08	c-g
Buster (U)	38.01	fg	18.93	d-g	16.08	hij
Buster (V)	48.31	a-f	15.88	f-k	31.09	c-f
Buster (N)	54.18	a-d	12.52	i-l	40.19	abc
Amanda (U)	41.67	d-g	23.59	cde	15.22	j
Amanda (V)	45.45	b-g	24.50	bcd	18.57	g-j
Amanda (N)	47.15	b-f	17.06	f-i	28.29	c-h
Karelia (U)	48.37	a-f	17.12	f-i	29.69	c-g
Karelia (V)	51.96	a-e	25.34	bc	24.04	e-j
Karelia (N)	60.55	a	14.03	g-l	44.98	a
Paradox (U)	33.23	g	14.33	g-l	15.78	ij
Paradox (V)	43.96	c-g	15.27	f-k	26.95	d-j
Paradox (N)	48.80	a-f	15.17	f-k	32.06	b-f
Olivia (U)	49.17	a-f	31.97	a	14.88	j
Olivia (V)	56.49	abc	33.19	a	20.61	f-j
Olivia (N)	51.59	a-e	29.74	ab	18.37	g-j
Bruar (U)	49.01	a-f	10.71	klm	36.91	a-d
Bruar (V)	53.07	a-e	16.31	f-j	35.68	a-e
Bruar (N)	58.19	ab	13.29	h-l	43.57	ab
LSD P=.05	12.94		5.59		12.25	
Standard Deviation	9.19		3.97		8.70	
CV	19.34		21.71		31.94	

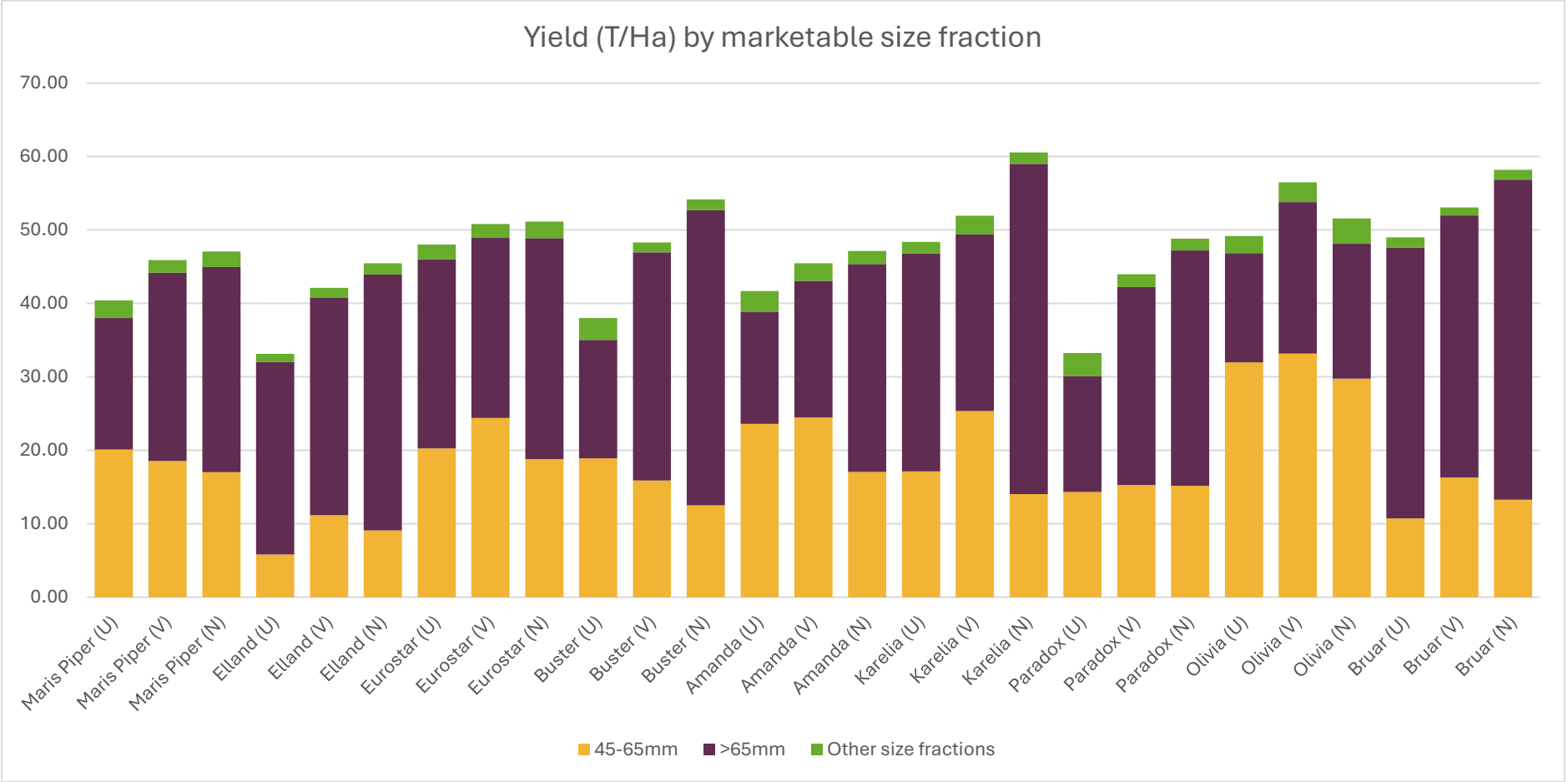

Figure 7 – Total yield (tonnes per hectare) of each variety by treatment – (U) untreated, (V) Velum Prime, or (N) Nemathorin.

For every variety tested there was an increase in total yield when a nematicide was applied compared to the untreated plots. Only Buster and paradox saw a statistically significant difference in total yield when comparing untreated with treated (both was observed in the Nemathorin treated plots). Generally, Velum Prime gives a yield boost when compared to the untreated control for each variety but consistently gives a lower yield when compared to the Nemathorin treatment. Interestingly for the 45-65 mm fraction, Buster untreated has a higher T/Ha than the Velum Prime and Nemathorin treatments, however, there was significantly larger yields for both treatments compared to the untreated yield in the >65 mm fraction. There is statistically significant difference in the >65 mm fraction between untreated and Nemathorin treated yields for Amanda, Karelia, and Paradox.

Tuber Numbers (No./Ha) by Variety													
	<25mm	25-30mm	30-35mm	35-40mm	40-45mm	45-50mm	50-55mm	55-60mm	60-65mm	65-70mm	70-75mm	75-80mm	>80mm
Maris Piper	7407 b	9259 abc	10802 ab	11111 bcd	18519 bc	22222 bc	35185 bc	32716 c	37037 bcd	31482 bc	25617 bc	12037 bc	6173 def
Elland	1852 c	4012 d	8333 ab	7099 d	12654 c	8951 e	14197 e	14506 d	19753 e	21914 c	16667 c	17593 ab	24074 a
Eurostar	8642 ab	10185 ab	12963 a	14815 ab	14197 bc	27161 b	33334 bc	38580 bc	41358 b	38889 ab	22840 bc	12037 bc	8951 cde
Buster	5247 bc	5864 cd	8025 ab	11111 bcd	16358 bc	18519 bcd	20370 de	30864 c	28087 cde	33025 b	23457 bc	15432 b	10494 bcd
Amanda	5247 bc	7407 bcd	12654 ab	14815 ab	20988 ab	23457 bc	37963 b	48457 b	43519 b	38272 ab	20062 c	10494 bc	3395 ef
Karelia	4321 bc	4630 d	9259 ab	13272 abc	17901 bc	22222 bc	32407 bc	40432 bc	43519 b	45679 a	31482 b	18519 ab	14815 bc
Paradox	7407 b	10185 ab	7407 b	13889 abc	17901 bc	17593 cde	27161 cd	30864 c	27161 de	20988 c	19136 c	12346 bc	15741 b
Olivia	12654 a	12037 a	11111 ab	18827 a	25926 a	36420 a	50617 a	64198 a	66975 a	41049 ab	16667 c	5247 c	1852 f
Bruar	1543 c	4938 d	8642 ab	8951 cd	12963 c	12037 de	20988 de	31482 c	39197 bc	45679 a	42901 a	25617 a	25309 a
LSD P=0.05	5122	4282	5413	5815	7312	9143	10551	11015	11287	10883	9499	8206	6767
Std Dev	6301	5268	6660	7155	8997	11249	12981	13552	13887	13390	11687	10097	8326
CV	104	69	67	57	51	54	43	37	36	38	48	70	68

Tuber Numbers (No./Ha) by Variety													
	<25mm	25-30mm	30-35mm	35-40mm	40-45mm	45-50mm	50-55mm	55-60mm	60-65mm	65-70mm	70-75mm	75-80mm	>80mm
Untreated	7202 a	9156 a	11728 a	14198 a	18724 a	23663 a	33436 a	36728 a	35905 b	33436 a	19650 b	13272 a	8025 b
Velum Prime	6584 a	6070 b	8230 b	12037 a	16770 a	22840 a	31173 ab	39815 a	45576 a	36111 a	24897 ab	13889 a	9568 b
Nemathorin	4321 a	7613 ab	9774 ab	11728 a	16975 a	16358 b	26132 b	34156 a	34054 b	36111 a	28395 a	15947 a	19342 a
LSD P=.05	2957	2472	3125	3357	4222	5279	6091	6359	6516	6283	5484	4738	3907
Std Dev	6301	5268	6660	7155	8997	11249	12981	13552	13887	13390	11687	10097	8326
CV	104	69	67	57	51	54	43	37	36	38	48	70	68

Tuber Numbers (No./Ha) by Variety																						
	<25mm		25-30mm		30-35mm		35-40mm		40-45mm		45-50mm		50-55mm		55-60mm		60-65mm		65-70mm		70-75mm		75-80mm		>80mm	
Maris Piper (U)	8333	b-f	12037	abc	11111	abc	12037	cde	21296	b-f	31482	a-d	43519	a-d	36111	c-g	34259	e-i	29630	d-g	20371	c-h	8334	fgh	2778	hi
Maris Piper (V)	11111	abc	4630	cde	9259	abc	10185	de	14815	c-f	16667	d-g	29630	d-k	29630	e-h	43518	c-h	32408	b-g	24074	c-h	13889	c-h	7408	ghi
Maris Piper (N)	2778	c-f	11111	a-d	12037	abc	11111	cde	19445	b-f	18519	c-g	32407	c-i	32407	d-h	33333	e-i	32408	b-g	32407	bcd	13889	c-h	8334	f-i
Elland (U)	0	f	3704	de	6482	bc	2778	e	12963	ef	10185	fg	11111	l	8333	i	12037	j	18519	g	12037	gh	25000	a-d	17593	d-g
Elland (V)	926	ef	3704	de	5556	c	10185	de	12037	ef	10185	fg	13889	jkl	18519	ghi	29630	g-j	24074	fg	21297	c-h	12037	d-h	23148	bcd
Elland (N)	4630	b-f	4630	cde	12963	abc	8333	de	12963	ef	6481	g	17593	h-l	16667	hi	17593	ij	23149	fg	16667	d-h	15741	b-g	31482	abc
Eurostar (U)	10185	a-d	8333	b-e	15741	ab	20371	abc	9259	f	34260	abc	26852	d-l	40741	c-f	38889	d-h	30556	c-g	23148	c-h	14815	c-h	9259	e-i
Eurostar (V)	9259	a-e	9259	b-e	9259	abc	12963	cd	14815	c-f	26852	a-e	37963	b-g	39815	c-f	50926	b-f	46297	a-d	24074	c-h	6482	fgh	4630	hi
Eurostar (N)	6482	b-f	12963	ab	13889	abc	11111	cde	18518	b-f	20370	b-g	35185	b-h	35185	c-h	34260	e-i	39815	a-f	21296	c-h	14815	c-h	12963	d-h
Buster (U)	11111	abc	8333	b-e	12963	abc	13889	bcd	28704	ab	25000	a-f	32408	c-i	37037	c-g	29630	g-j	31482	c-g	14815	fgh	3704	gh	3704	hi
Buster (V)	2778	c-f	5556	b-e	4630	c	9259	de	9259	f	15741	d-g	15741	i-l	32408	d-h	30556	g-j	34259	a-g	26852	b-h	19445	a-f	9259	e-i
Buster (N)	1852	def	3704	de	6482	bc	10186	de	11111	ef	14815	efg	12963	kl	23148	f-i	24074	hij	33334	b-g	28704	b-f	23148	a-e	18519	d-g
Amanda (U)	9259	a-e	7407	b-e	16667	a	24074	a	21296	b-f	34259	abc	43518	a-d	49074	a-d	46296	c-g	25926	efg	14815	fgh	11111	d-h	1852	hi
Amanda (V)	2778	c-f	11111	a-d	12963	abc	10185	de	23148	a-e	22222	b-g	38889	b-f	53704	abc	52778	a-e	39815	a-f	19445	c-h	7407	fgh	0	i
Amanda (N)	3704	b-f	3704	de	8333	abc	10185	de	18519	b-f	13889	efg	31482	c-j	42593	b-e	31482	f-j	49074	abc	25926	b-h	12963	c-h	8333	f-i
Karelia (U)	3704	b-f	4630	cde	11111	abc	12963	cd	12037	ef	20371	b-g	27778	d-l	37963	c-f	38889	d-h	52778	a	31482	b-e	12963	c-h	8334	f-i
Karelia (V)	6481	b-f	4630	cde	10185	abc	17593	a-d	25926	a-d	34259	abc	48148	abc	50926	a-d	56482	a-d	40741	a-f	33334	bc	12963	c-h	1852	hi
Karelia (N)	2778	c-f	4630	cde	6482	bc	9259	de	15741	c-f	12037	efg	21297	f-l	32408	d-h	35185	e-i	43519	a-e	29630	b-f	29630	ab	34259	ab
Paradox (U)	12037	ab	17593	a	10185	abc	20370	abc	26852	abc	16667	d-g	34260	b-h	27778	e-h	25000	hij	19445	g	11112	h	10185	e-h	7408	ghi
Paradox (V)	6482	b-f	6482	b-e	5556	c	12037	cde	13889	def	21296	b-g	24074	e-l	32408	d-h	27778	g-j	20370	g	18519	c-h	16667	b-g	17593	d-g
Paradox (N)	3704	b-f	6481	b-e	6481	bc	9260	de	12963	ef	14815	efg	23148	e-l	32408	d-h	28704	g-j	23148	fg	27778	b-g	10185	e-h	22222	cd
Olivia (U)	9259	a-e	12037	abc	12037	abc	12963	cd	21296	b-f	34260	abc	59259	a	65741	a	69445	ab	41667	a-f	14815	fgh	926	h	926	i
Olivia (V)	17593	a	5556	b-e	10185	abc	23148	ab	22223	a-e	39815	a	51852	ab	61111	ab	72222	a	45370	a-d	15741	e-h	9259	e-h	2778	hi
Olivia (N)	11111	abc	18519	a	11111	abc	20371	abc	34259	a	35185	ab	40741	b-e	65741	a	59259	abc	36111	a-g	19445	c-h	5556	fgh	1852	hi
Bruar (U)	926	ef	8333	b-e	9260	abc	8333	de	14815	c-f	6482	g	22222	f-l	27778	e-h	28704	g-j	50926	ab	34259	bc	32408	a	20370	cde
Bruar (V)	1852	def	3704	de	6481	bc	2778	e	14815	c-f	18519	c-g	20370	g-l	39815	c-f	46296	c-g	41667	a-f	40741	ab	26852	abc	19445	def
Bruar (N)	1852	def	2778	e	10185	abc	15741	a-d	9260	f	11112	efg	20370	g-l	26852	e-i	42593	c-h	44444	a-e	53704	a	17593	b-g	36111	a
LSD P=.05	2957		2472		3125		3357		4222		5279		6091		6359		6516		6283		5484		4738		3907	
Std Dev	6301		5268		6660		7155		8997		11249		12981		13552		13887		13390		11687		10097		8326	
CV	104		69		67		57		51		54		43		37		36		38		48		70		68	

Marketable tuber number fractions by variety and treatment						
	Total		45-65mm		>65mm	
Maris Piper	259568	cd	127161	cd	75309	c
Elland	171605	e	57407	f	80247	c
Eurostar	283951	bc	140432	bc	82716	c
Buster	226852	d	97840	e	82407	c
Amanda	286729	bc	153395	b	72222	c
Karelia	298457	b	138580	bc	110494	b
Paradox	227778	d	102778	e	68210	c
Olivia	363580	a	218210	a	64815	c
Bruar	280247	bc	103704	de	139506	a
LSD P=.05		38112		23532		21912
Std Dev		46892		28953		26960
CV		18		23		31

	Total		45-65mm		>65mm	
Untreated	265123	a	129732	a	74383	b
Velum Prime	273560	a	139403	a	84465	b
Nemathorin	260905	a	110700	b	99794	a
LSD P=.05	22004		13586		12651	
Std Dev	46892		28953		26960	
CV	18		23		31	

Marketable tuber number fractions by variety and treatment						
	Total		45-65mm		>65mm	
Maris Piper (U)	271297	e-h	145371	def	61111	fgh
Maris Piper (V)	247222	e-j	119444	e-h	77778	d-h
Maris Piper (N)	260185	e-h	116667	e-h	87037	d-g
Elland (U)	140741	k	41667	k	73148	d-h
Elland (V)	185185	jk	72222	ijk	80556	d-h
Elland (N)	188889	ijk	58334	jk	87037	d-g
Eurostar (U)	282407	d-g	140741	d-g	77778	d-h
Eurostar (V)	292593	c-f	155556	cde	81482	d-h
Eurostar (N)	276852	e-h	125000	e-h	88889	d-g
Buster (U)	252778	e-i	124074	e-h	53704	gh
Buster (V)	215741	hij	94445	hij	89815	d-g
Buster (N)	212037	hij	75000	ijk	103704	b-e
Amanda (U)	305556	b-e	173148	bcd	53704	gh
Amanda (V)	294445	b-f	167593	bcd	66667	e-h
Amanda (N)	260185	e-h	119445	e-h	96296	c-f
Karelia (U)	275000	e-h	125000	e-h	105556	bcd
Karelia (V)	343519	a-d	189815	abc	88889	d-g
Karelia (N)	276852	e-h	100926	ghi	137037	ab
Paradox (U)	238889	f-j	103704	ghi	48148	h
Paradox (V)	223148	g-j	105555	f-i	73148	d-h
Paradox (N)	221296	g-j	99074	hij	83334	d-h
Olivia (U)	354630	abc	228704	a	58333	gh
Olivia (V)	376852	a	225000	a	73148	d-h
Olivia (N)	359259	ab	200926	ab	62963	fgh
Bruar (U)	264815	e-h	85185	hij	137963	ab
Bruar (V)	283334	d-g	125000	e-h	128704	abc
Bruar (N)	292593	c-f	100926	ghi	151852	a
LSD P=.05		66012		40759		37952
Standard Deviation		46892		28953		26960
CV		18		23		31

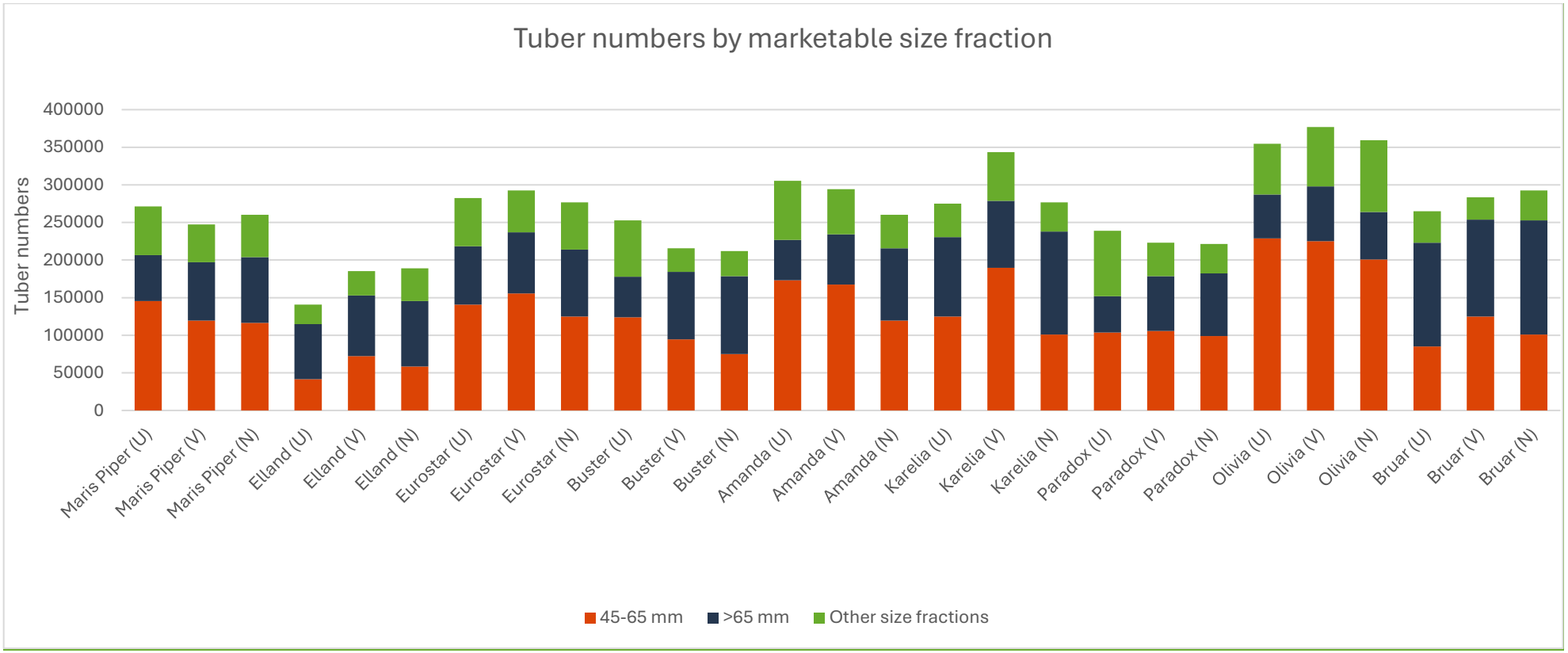

Figure 8 - Total tuber numbers (per ha) for untreated (U), Velum Prime (V), and Nemathorin (N) treated varieties.

The change in tuber numbers by nematicide treatment is variable. When compared to the untreated plots, treatment with Velum Prime and/or Nemathorin has improved total tuber numbers for Elland, Eurostar, Karelia, Olivia and Bruar, although none were statistically significant.

Differences between the yield of untreated and treated plots provides a measure of PCN tolerance. If a variety produces a similar yield across both treated and untreated plots it would be considered tolerant. This year, every tested variety had yield increases in the treated plots compared to untreated. For all varieties except Olivia, Nemathorin treated plots produced higher yields than plots treated with Velum Prime. Generally, there was no significant effect of Velum Prime or Nemathorin application on the number of tubers harvested. The differences observed are far more likely to be attributable to varietal differences.

Olivia, Eurostar and Amanda all proved to be tolerant varieties confirming previously collected data. Similarly, Maris Piper demonstrated moderately tolerant characteristics known to be possible with this variety. Unlike previous years, Buster and Elland struggled to demonstrate PCN tolerance which is possibly a reflection of uneven infection pressures across the trial site. Differences in tolerance can be affected by external factors such as weather conditions across the growing season. As with the data from 2023, this trial suffered from a wetter than average spring resulting in delayed planting. It is impossible to say how this may have affected varietal tolerance using the data that was collected.

Tuber blemish diseases

Table 7 - Incidence and severity of Common scab (Streptomyces spp.), Powdery scab (Spongospora subterranea), Netting, Splits, Black dot (Colletotrichum coccodes), black scurf (Rhizoctonia solani) and silver scurf (Helminthosporium solani) on harvested tubers.

Treatment	Netting Incidence %		Splits Incidence %		Splits Severity 0-2		Splits Severity 0		Splits Severity 1		Splits Severity 2		Rhizoctonia Incidence %		Black Scurf Incidence %	Black Scurf Severity 0-3
Maris Piper	77.5	ab	1.5	c	0.020	cd	98.5	a	1.0	b	0.5	cd	55.3	a	0	0
Elland	63.5	b	5.5	abc	0.090	abc	94.5	abc	2.0	ab	3.5	abc	70.0	a	0	0
Eurostar	86.5	a	10.0	a	0.155	a	90.0	c	4.5	a	5.5	a	53.0	a	0	0
Buster	81.5	a	1.5	c	0.020	cd	98.5	a	1.5	b	0	d	56.0	a	0	0
Amanda	88.0	a	1.0	c	0.010	d	99.0	a	1.0	b	0	d	75.5	a	0	0
Karelia	86.0	a	3.0	c	0.045	cd	97.0	a	1.5	b	1.5	cd	67.0	a	0	0
Paradox	82.5	a	5.0	bc	0.070	bcd	95.0	ab	3.0	ab	2.0	bcd	53.0	a	0	0
Olivia	82.0	a	8.0	ab	0.130	ab	92.0	bc	3.0	ab	5.0	ab	71.5	a	0	0
Bruar	87.5	a	1.5	c	0.025	cd	98.5	a	0.5	b	1.0	cd	70.5	a	0	0
LSD P=.05		16.92		4.72		0.08		4.72		2.58		3.18		25.47	.	.
Standard Deviation		11.59		3.23		0.05		3.23		1.77		2.18		17.45	0	0
CV		14.20		78.68		83.88		3.37		88.45		103.14		27.47	0	0

Treatment	Common Scab Incidence %		Common Scab Severity 0-3		Common Scab Severity 0		Common Scab Severity 1		Common Scab Severity 2		Common Scab Severity 3		Powdery Scab Incidence %		Powdery Scab Severity 0-3		Powdery Scab Severity 0		Powdery Scab Severity 1		Powdery Scab Severity 2		Powdery Scab Severity 3	
Maris Piper	87.0	a	1.610	a	13.0	e	36.5	bc	27.0	ab	23.5	a	20.5	a	0.220	ab	79.5	b	19.0	a	1.5	ab	0	a
Elland	34.5	de	0.385	de	65.5	ab	31.5	bcd	2.0	e	1.0	b	18.0	a	0.255	ab	82.0	b	13.5	abc	1.5	ab	3.0	a
Eurostar	52.0	c	0.650	cd	48.0	c	39.5	abc	12.0	cde	0.5	b	15.5	ab	0.270	ab	84.5	ab	7.5	bc	4.5	ab	3.5	a
Buster	74.5	ab	1.050	b	25.5	de	48.5	a	21.5	abc	4.5	b	26.5	a	0.375	a	73.5	b	19.0	a	4.0	ab	3.5	a
Amanda	44.0	cd	0.525	cde	56.0	bc	37.5	bc	4.5	de	2.0	b	17.0	ab	0.220	ab	83.0	ab	13.0	abc	3.0	ab	1.0	a
Karelia	25.5	e	0.275	e	74.5	a	23.5	d	2.0	e	0	b	17.0	ab	0.235	ab	83.0	ab	12.0	abc	3.5	ab	1.5	a
Paradox	88.0	a	1.725	a	12.0	e	31.0	cd	29.5	a	27.5	a	22.3	a	0.290	a	77.8	b	16.5	ab	4.8	a	1.0	a
Olivia	55.5	c	0.835	bc	44.5	c	35.0	bc	13.0	cd	7.5	b	22.0	a	0.260	ab	78.0	b	18.5	a	3.0	ab	0.5	a
Bruar	70.0	b	1.088	b	30.0	d	41.8	ab	18.0	bc	10.3	b	4.0	b	0.040	b	96.0	a	4.0	c	0	b	0	a
LSD P=.05	13.83		0.34		13.83		10.62		10.20		11.68		13.92		0.24		13.92		9.74		4.74		4.31	
Std Dev	9.48		0.23		9.48		7.28		6.99		8.01		9.54		0.16		9.54		6.67		3.25		2.96	
CV	16.06		25.61		23.12		20.17		48.57		93.88		52.74		67.20		11.64		48.83		113.46		190.06	

Treatment	Silver Scurf						Black Dot					
	Incidence %	Severity 0-3	Severity 0	Severity 1	Severity 2	Severity 3	Incidence %	Severity 0-3	Severity 0	Severity 1	Severity 2	Severity 3
Maris Piper	15.0 b	0.175 b	85.0 a	12.5 b	2.5 a	0 a	3.0 b	0.035 bc	97.0 ab	2.5 b	0.5 b	0
Elland	25.0 ab	0.295 ab	75.0 ab	21.0 ab	3.5 a	0.5 a	1.5 b	0.015 c	73.5 b	1.5 b	0 b	0
Eurostar	25.0 ab	0.300 ab	75.0 ab	20.5 ab	4.0 a	0.5 a	3.0 b	0.035 bc	97.0 ab	2.5 b	0.5 b	0
Buster	30.5 ab	0.310 ab	69.5 ab	30.0 a	0.5 a	0 a	2.0 b	0.020 c	98.0 a	2.0 b	0 b	0
Amanda	25.5 ab	0.300 ab	74.5 ab	21.0 ab	4.5 a	0 a	3.5 b	0.125 ab	96.5 ab	3.5 b	0 b	0
Karelia	38.0 a	0.435 a	62.0 b	32.5 a	5.5 a	0 a	3.5 b	0.040 bc	96.5 ab	3.0 b	0.5 b	0
Paradox	37.8 a	0.485 a	62.3 b	29.0 a	6.8 a	2.0 a	3.5 b	0.035 bc	96.5 ab	3.5 b	0 b	0
Olivia	31.0 ab	0.325 ab	69.0 ab	29.5 a	1.5 a	0 a	16.5 a	0.190 a	83.5 ab	14.0 a	2.5 a	0
Bruar	36.0 a	0.413 ab	64.0 b	31.8 a	3.3 a	1.0 a	3.5 b	0.040 bc	96.5 ab	3.0 b	0.5 b	0
LSD P=.05	17.86	0.26	17.86	13.35	7.01	2.13	2.32	0.09	23.72	2.54	1.30	.
Standard Deviation	12.23	0.18	12.23	9.14	4.80	1.46	1.59	0.06	16.25	1.74	0.89	0
CV	41.75	51.98	17.31	36.14	135.04	327.63	35.77	106.35	17.52	44.05	178.47	0

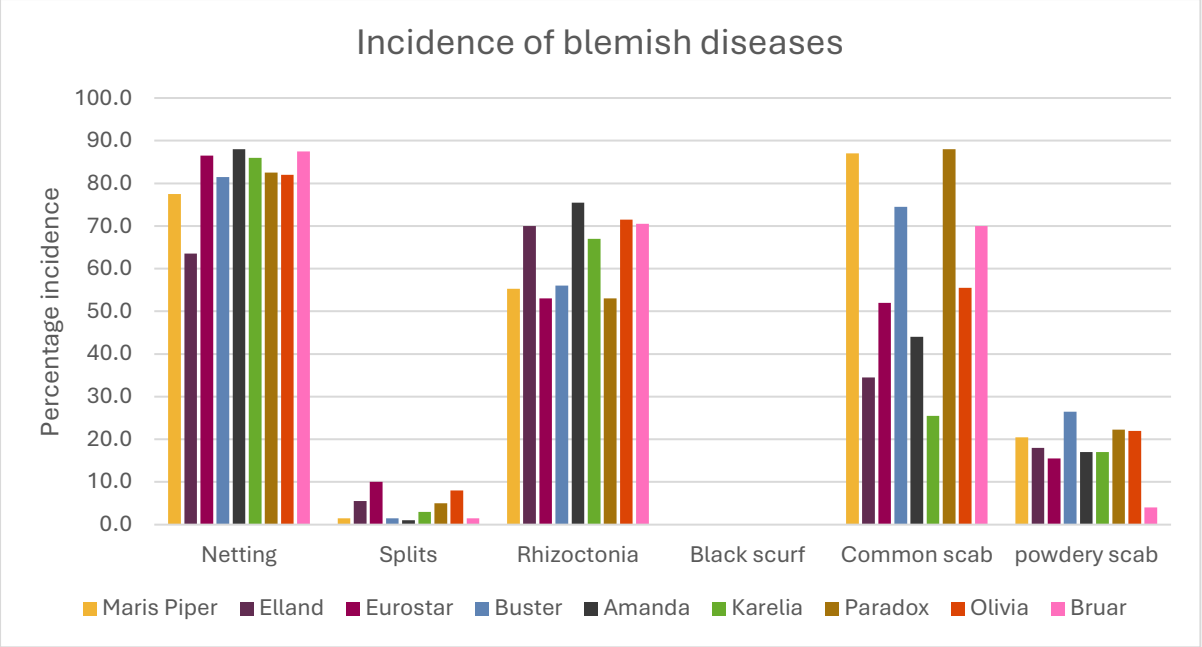

Figure 9 - Percentage incidence of blemish disease by variety

While PCN are currently the most significant potato pathogen in the UK, it is important to also consider the resistance/susceptibility status of these varieties to other common blemish diseases. Tubers from the untreated plots were all assessed for common scab, Powdery scab, black scurf (*Rhizoctonia*), and silver scurf. Tubers were also assessed for netting and splits as these symptoms can be caused by multiple blemish diseases. Overall there was a high occurrence of multiple blemish diseases across all varieties at this trial site.

The incidence of common scab was variable, ranging from 25.5% in Karelia to 88% in Paradox. The trial site was not irrigated this year due to rain volume across the season. Powdery scab was present at low incidence takes across all varieties. Only Maris Piper, Buster, and Paradox exceeded 20% incidence.

There was a high incidence of netting across all varieties, ranging from 63.5% to 88%. Netting is a symptom that can be caused by multiple blemish diseases such as black scurf and scab. Incidence of splitting was low, ranging between 1% in Amanda and 10% in Eurostar.

There was no incidence of black scurf symptoms seen in the trial this year but there were high incidences of *Rhizoctonia* ranging from 53% to 75.5%.

Discussion

The final year of field trials for the PCN Action Scotland project has provided further evidence of the large effect of varieties highly resistant to *G. pallida* can have on the pest population. Assessments which have been affected by PCN and/or nematicide treatment include emergence timings, ground cover, post-harvest PCN population (Pf) and Pf/Pi Ratios, yield (T/Ha) and tuber numbers. Elland, Eurostar, Buster, Amanda, and Karelia all had a Pf/Pi ratio under 1 meaning they reduced the PCN population present. In contrast, the *G. pallida* susceptible and partially resistant varieties (Maris Piper and Bruar) resulted in increases in the pest population at harvest (Pi/Pf ratio of 28.14 and 2.08) respectively in untreated plots). Paradox gave a Pf/Pi ratio of under 1 for the untreated plots over 1 for Velum Prime and Nemathorin treated plots with pf/pi ratios of 1.37 and 1.11 respectively. Resistance is a powerful tool in the management of PCN populations and varietal choice should be treated as the most important tool when trying to reduce a PCN problem.

Of these varieties, Elland and Paradox have resistance only to *G. pallida* and not to *G. rostochiensis*. However, Eurostar, Buster, Karelia, Amanda, and Bruar are resistant to both species of PCN present in Scotland. The effect on a *G. rostochiensis* population was not assessed in this field trial as G. *rostochiensis* was not detectable at this site. Although *G. rostochiensis* is now the lesser found PCN species in Scotland, it should not be forgotten about. Switching to varieties only resistant against *G. pallida* will cause a swing back towards *G. rostochiensis* prevalence. From an integrated pest management (IPM) perspective, highly resistant varieties are not necessary if no PCN has been detected. If a field has previously had PCN present but is no longer detectable then PCN is likely to still be there but just below detectable levels. In this instance resistant varieties should be used however partially resistant varieties can be considered here. A larger detectable PCN population should be combatted using highly resistant varieties specific to the species of PCN present.

Some of the differences observed in this trial can be put down to varietal characteristics rather that being a direct impact of nematicide treatment or the presence of a moderate-high PCN population. This includes plant number, internal defects, soft rots, dry matter, density, and skin finish assessments.

Nematicide treatment has shown to reduce PCN populations marginally, however, it is thought that the main cause for these reductions if from the use of highly resistant potato varieties. To achieve the most effective reduction of PCN in an infested field a resistant variety should be planted alongside the use of a nematicide to safeguard yields. Reliance on resistant varieties will become even more pivotal in future when nematicides are removed from use. For example Nemathorin currently has a use expiry date of 31/07/2029. Without Nemathorin in the arsenal there will be significantly less products available to protect crop yields in PCN infested fields.

Acknowledgements

The trial site was provided by Mr Neill Smith, Barnyards Farm, Tannadice, Forfar, DD8 3QA with Scottish Agronomy field staff planting, harvesting, and managing the field trial. FERA undertook the analysis of PCN soil samples.

Funding for this work was provided by the Scottish Government through Scotland's Plant health Centre.

A final thank you to everyone who supported and attended the trials open days across the length of the PCN Action Scotland project.

Appendix

Photographs of the PCN Field trials at Barnyards farm 2024


PCN
PCN


PCN