

AHDB Potatoes SPot Farm East 2021

Evaluation of Varietal Tolerance and Resistance to Potato Cyst Nematode *Globodera pallida*

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1. SUMMARY

A site in Suffolk with a known history of Potato Cyst Nematode (PCN) was used. Soil test results indicated that *Globodera pallida* was present. Comparison of yield in nematicide-treated versus untreated plots was used to assess varietal tolerance to potato cyst nematodes (*Globodera pallida*). Nematode multiplication (the Pf:Pi ratio) was used to give an indication of varietal resistance to *G. pallida*. There were considerable differences in the level of multiplication of *G. pallida* on this site between varieties.

- Treatment with granular nematicide containing fosthiazate at planting significantly improved yield (7.4% increase)
- Treatment with granular nematicide containing fosthiazate at planting demonstrated a trend to reduce multiplication of PCN within plots of the *G. pallida*-susceptible variety Maris Peer
- No recommendations of varietal tolerance could be obtained from this trial due to limited yield decline with increasing PCN levels, even within the block with the highest level of initial PCN (17-33 eggs/g soil)
- Options now exist within both pre-pack (Lanorma, Karelia, Buster) and salad production (Empress, Iodea) to reduce *G. pallida* multiplication over a standard 6-year rotation.

2. INTRODUCTION

Varietal resistance and varietal tolerance to PCN are two important aspects to consider when managing PCN. The use of highly resistant varieties is the most effective control measure for suppressing PCN multiplication.

- **Resistance** refers to the ability of a variety to limit the increase in population of PCN and, in some instances, to reduce numbers of this pest. It is measured by the ratio of Pi (initial egg numbers at planting) to Pf (final egg numbers after harvest).

Resistance to PCN is assessed as part of National List testing. Tubers are planted in pots in compost infected with a standard concentration of PCN eggs. The scoring system is based on 'relative susceptibility' which is calculated by expressing the PCN population produced on a standard susceptible variety e.g. Desiree. The results are presented using a 1-9 scale (9 = highest resistance). For example, if a variety limits PCN multiplication to 50% of that on Desiree, it will have a resistance score of 3. A variety with a resistance score of 9 limits PCN multiplication to less than 1% when compared with Desiree.

- A variety is considered **Tolerant** to PCN if the yield is not reduced in the presence of PCN compared to the yield in the absence of PCN in the same field situation.

Tolerance is sometimes measured by the difference in yield between plots treated or untreated with nematicide. This method is imperfect because nematicide treatment provides incomplete and variable levels of nematode control, depending on a variety of environmental factors. However, other test methods have not proved reliable (eg see AHDB Project 11120026 which used 1 tonne boxes containing PCN free soil inoculated with a known number of PCN cysts).

Soil type, particularly the ability of the soil to hold water, has a major influence, so irrigation can improve the tolerance of a crop. Some resistant varieties are tolerant because they suffer less from the feeding of developing female nematodes. In general, the more vigorous and late-maturing varieties with strong top growth are the most tolerant because they are able to compensate for loss in leaf area caused by nematode damage.

A trial was established to assess variety tolerance and resistance in the field as part of the SPot East programme in 2021.

3. MATERIALS AND METHODS

A site with a known history of PCN was chosen at Woodbridge (Suffolk), the soil type being a Loamy Sand. Field Name Rolph Ex Beet. A 1ha area within the field was selected based on previous PCN mapping and levels confirmed by 40 core PCN soil samples using a 15 mm soil corer to a depth of 15 – 20 cm. This area was sub divided into 25.0 x 25.0m quadrats and a further 100 g soil sample taken from each area for PCN analysis. An amalgamated sample from all plots was analysed for PCN species confirmation. Based on these results a suitable trial location was chosen and the trial marked out on 20th April 2021. The trial was of a stratified block design with 4 replicates. The initial population levels of the stratified blocks were:

- Block 1 Initial population 2-8 eggs/g
- Block 2 Initial population 8-11 eggs/g
- Block 3 Initial population 11-16 eggs/g
- Block 4 Initial population 17-33 eggs/g

The trial area was sub divided into 80 plots 3.66 m (2 beds) by 5.50 m. On 20th April, all plots were sampled for PCN using a 15 mm soil corer to a depth of 15 – 20 cm collecting 30 cores per plot (15 cores each from 2 harvest rows). Samples were analysed by Anglian Soil Analysis, Sutterton laboratory and results reported on 29th April.

Granular nematicide treatments were applied using a hand-held shaker to the destoned beds and incorporated to a depth of 15.0 - 20.0 cm using a Bye Engineering front mounted bed-tiller on 11th May; see Treatment List (Figure 1). Post incorporation ridges were formed in all plots using a Bye Engineering ridger. On 11th May, all plots were hand planted at 30.0 cm spacing, using a marked planting string, to a depth of 10cm within an opened out row formed by a tractor mounted toolbar. All plots were mechanically re-ridged to cover seed tubers.

All seed was pre-treated with Ernesto Prime (penflufen) at a rate of 1.0 kg/tonne. The trial area received no additional commercial nematicides; all other inputs were as per the surrounding commercial crop for the duration of the trial.

Figure 1. Treatment list.

Trt No.	Variety	Treatment	Active Ingredient	Application Rate
1	Buster	Untreated	-	-
2	Buster	Nemathorin 10G	Fosthiazate (10.0 %	30.0 kg/ha
3	Elland	Untreated	-	-
4	Elland	Nemathorin 10G	Fosthiazate (10.0 %	30.0 kg/ha
5	Empress	Untreated	-	-
6	Empress	Nemathorin 10G	Fosthiazate (10.0 %	30.0 kg/ha
7	Iodea	Untreated	-	-
8	Iodea	Nemathorin 10G	Fosthiazate (10.0 %	30.0 kg/ha
9	Karelia	Untreated	-	-
10	Karelia	Nemathorin 10G	Fosthiazate (10.0 %	30.0 kg/ha
11	Lanorma	Untreated	-	-
12	Lanorma	Nemathorin 10G	Fosthiazate (10.0 %	30.0 kg/ha
13	Maris Peer	Untreated	-	-
14	Maris Peer	Nemathorin 10G	Fosthiazate (10.0 %	30.0 kg/ha
15	Marvel	Untreated	-	-
16	Marvel	Nemathorin 10G	Fosthiazate (10.0 %	30.0 kg/ha
17	Royal	Untreated	-	-
18	Royal	Nemathorin 10G	Fosthiazate (10.0 %	30.0 kg/ha
19	Tyson	Untreated	-	-
20	Tyson	Nemathorin 10G	Fosthiazate (10.0 %	30.0 kg/ha

All plots were assessed for emergence (until complete emergence was achieved) and ground cover (from complete emergence through to 30th August). The trial was desiccated by a tractor mounted flail followed by an application of Spotlight Plus (*carfentrazone-ethyl*) 1.0 l/ha on 16th September.

A 10 plant (2.745 m²) harvest was hand dug from guarded areas of all plots on 27th September and placed in commercial storage. Post-harvest, all plots were re-sampled for PCN as per the method above and 100 ml soil analysed for PCN by Anglian Soil Analysis with results reported on 15th November. On 7th December all harvest samples were size graded, counted and weighed.

4. RESULTS

Foliar Ground Cover

From 14th June onwards foliar ground cover was measured using the ground cover grid method, Figure 2. Considerable variation occurred between varieties.

Figure 2. Ground Cover (%) – All varieties +/- nematicide treatment

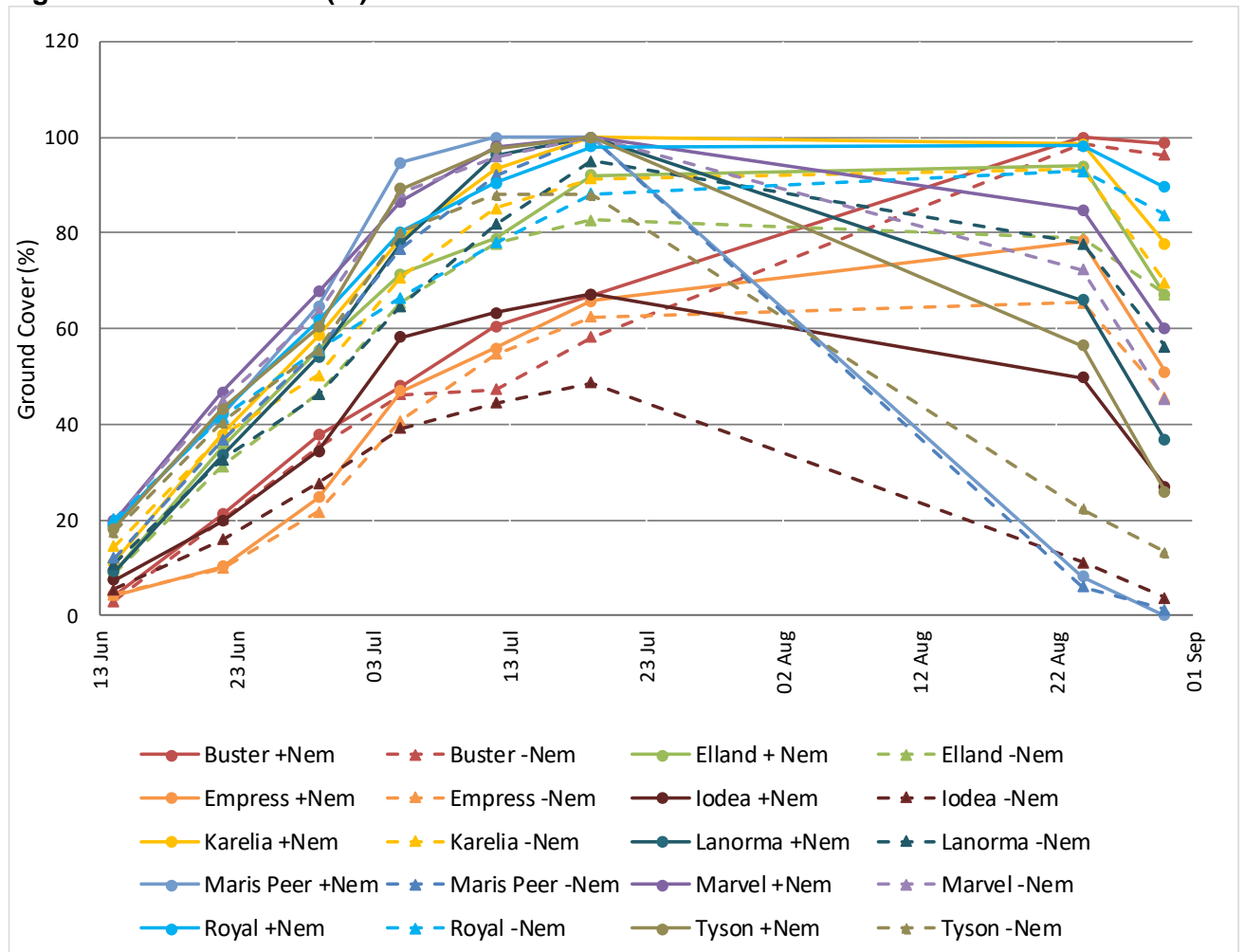
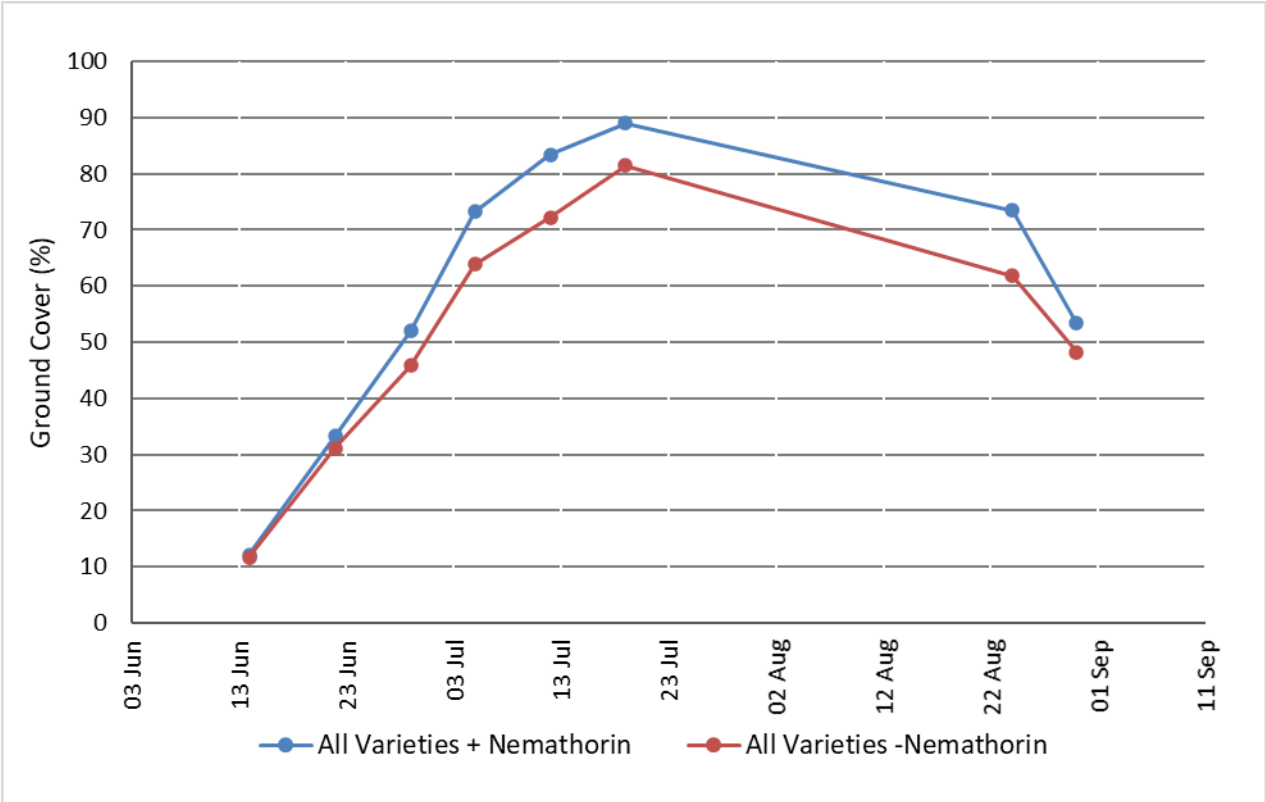
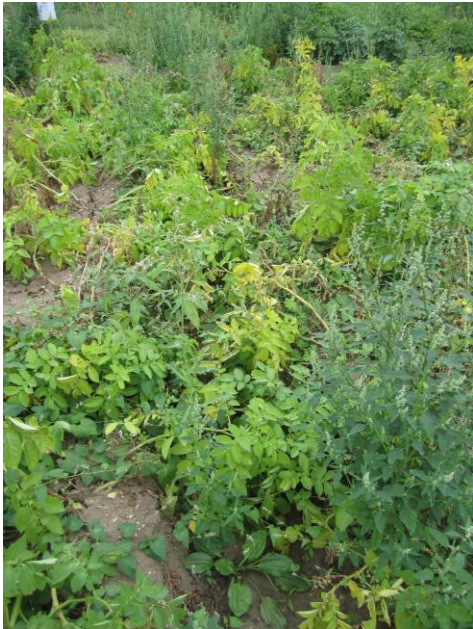


Figure 3 (below) shows a comparison of ground cover development of nematicide-treated and untreated plots (mean of all varieties). Canopy development increased at a marginally higher rate and was maintained over a longer prolonged period when a nematicide treatment was applied.

Figure 3. Ground Cover (%) mean of all varieties +/- nematicide treatment



Images of example plots on 3rd September, highlight some variation within later ground cover/vigour of Lanorma, Marvel & Royal plots when comparing treated to untreated plots which was not evident in the variety Buster.



4-57 Lanorma untreated



3-54 Lanorma + Nemathorin 10G (30 kg/ha)



4-72 Marvel untreated



3-67 Marvel + Nemathorin 10G (30.0 kg/ha)



4-35 Royal untreated



4-63 Royal + Nemathorin 10G (30.0 kg/ha)



4-77 Buster untreated



4-78 Buster + Nemathorin 10G (30.0 kg/ha)

Number of Tubers, Size Distribution and Gross Yield (all blocks)

On 27th September a 10-plant harvest was taken from the guarded centre rows of each plot (5 plants [1.50 m] per row; total 2.745 m². On 7th December all tubers were size graded, weighed and counted, Figure 5.

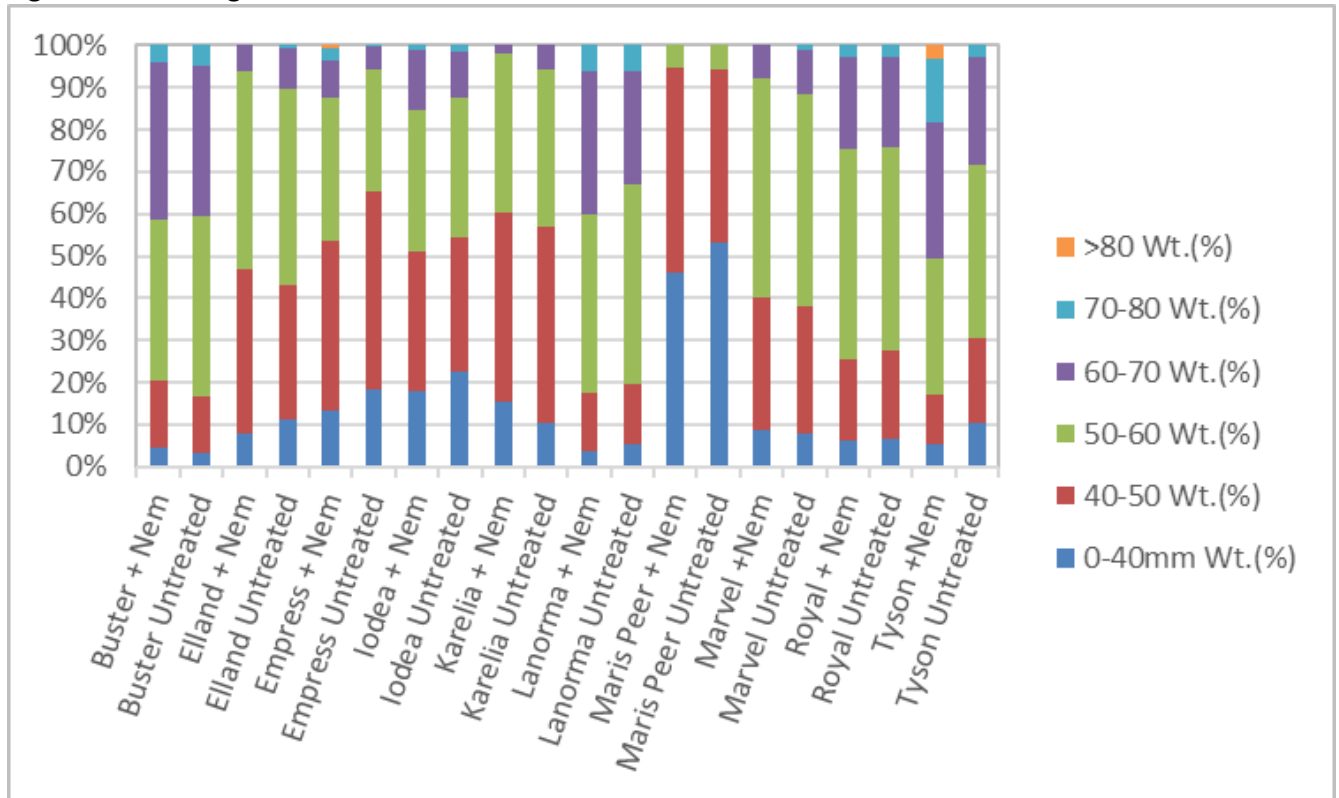
The application of Nemathorin (30 kg/ha) increased the yield of eight varieties within this trial (two varieties, Iodea and Empress were excluded from this analysis due to poor population affecting uniformity). Mean yield increase observed was 3.82 t/ha (7.4 %) over all varieties (excluding Iodea and Empress due to seed rots). A very low trend towards increased tuber numbers was observed with the use of Nematicide; mean increase was 0.8 %.

Figure 5. Tuber Size and Weight Distribution, Number of Tubers and Gross Yield.

		Tuber Size Distribution (% by weight)						Tuber No	Gross Yield
		<40 mm	40-50 mm	50-60 mm	60-70 mm	70-80 mm	80-90 mm	' 000 /Ha	t/ha
Variety	Treatment								
Buster	Nemathorin 10G	4.4	15.8	38.4	37.2	4.1	0.0	573,770	65.10
Buster	Untreated	3.3	13.4	42.7	35.5	5.0	0.0	484,517	65.07
Elland	Nemathorin 10G	7.9	38.7	47.1	6.2	0.0	0.0	725,865	57.67
Elland	Untreated	11.2	31.8	46.8	9.5	0.7	0.0	723,133	57.56
Empress	Nemathorin 10G	13.1	40.4	34.1	8.8	2.8	0.8	810,565	69.98
Empress	Untreated	18.4	47.0	29.0	5.2	0.4	0.0	1,011,840	74.39
Iodea	Nemathorin 10G	18.0	33.0	33.5	14.5	1.0	0.0	1,018,215	64.61
Iodea	Untreated	22.4	32.0	33.1	11.0	1.5	0.0	847,905	46.22
Karelia	Nemathorin 10G	15.3	45.2	37.6	1.9	0.0	0.0	781,421	54.85
Karelia	Untreated	10.2	46.6	37.5	5.7	0.0	0.0	724,954	51.93
Lanorma	Nemathorin 10G	3.5	13.8	42.4	34.2	6.1	0.0	508,197	56.38
Lanorma	Untreated	5.2	14.3	47.5	26.9	6.0	0.0	498,179	52.26
Maris Peer	Nemathorin 10G	46.1	48.5	5.3	0.0	0.0	0.0	990,893	41.92
Maris Peer	Untreated	53.4	41.1	5.6	0.0	0.0	0.0	1,102,914	40.32
Marvel	Nemathorin 10G	8.8	31.2	52.0	8.0	0.0	0.0	673,953	53.30
Marvel	Untreated	7.7	30.2	50.6	10.4	1.1	0.0	663,024	50.91
Royal	Nemathorin 10G	6.0	19.3	50.0	21.9	2.8	0.0	611,111	59.65
Royal	Untreated	6.4	21.1	48.2	21.6	2.7	0.0	546,448	52.23
Tyson	Nemathorin 10G	5.1	12.1	32.1	32.5	15.1	3.1	482,696	52.41
Tyson	Untreated	10.1	20.2	41.1	25.7	2.8	0.0	560,109	40.40
Average (excluding Iodea and Empress)	Nemathorin 10G							668,488	55.16
Average (excluding Iodea and Empress)	Untreated							662,910	51.34

The tuber size distribution (% by weight) (Figure 9) shows the size distribution profile of all varieties. Observed differences in tuber size distribution were greater between varieties than when comparing differences associated with the use of nematicide.

Figure 6. Percentage Tuber Size Distribution



PCN Levels (eggs/g) & Species identified Pre & Post Cropping

Soil PCN levels (eggs/g) were determined pre-treatment application [*P_i*] (reported 29th April) and post-harvest [*P_f*] (reported 15th November) by the removal of 30 soil cores per plot using a 15.0 mm corer to a depth of 15.0 – 20.0 cm, cores taken uniformly from across the plot. The sample of soil was sent to laboratory (Anglian Soil Analysis, Sutterton) and a 100g sub sample was analysed for PCN eggs & cysts. The blocks were then determined using a stratified design, Figure 7.

2 Beds	2 Beds	2 Beds	2 Beds	2 Beds
19	25	19	15	8
14	33	23	25	15
11	15	12	25	12
10	18	11	20	9
23	24	24	18	30
24	27	23	16	27
15	9	7	6	12
13	12	11	8	8
9	7	2	3	10
3	8	11	7	19
6	7	10	9	9
6	8	17	11	8
11	11	11	9	12
3	5	3	3	8
5	11	9	12	14
7	7	12	10	14

Block 1 2 - 8 eggs/g
Block 2 8-11 eggs/g
Block 3 11-16 eggs/g
Block 4 17-33 eggs/g

Figure 7. Plot pre egg/g levels coded by block

The average eggs/g and cysts/g by variety across all blocks including the ratio (*Pf:Pi*) of eggs post-harvest (*Pf*) and before planting (*Pi*) was calculated:

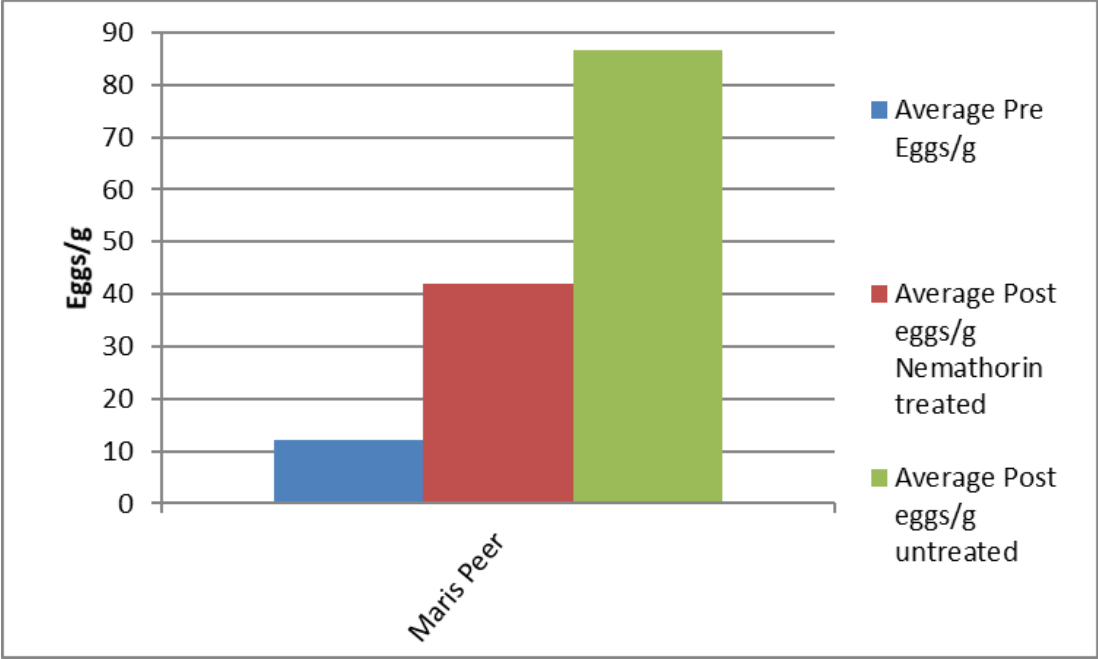
Figure 8. Cyst and Egg counts pre and post planting and Pf:Pi Ratio

Variety	Treatment	Average Pre-Planting Test		Average post Planting Test		Multiplication Ratio
		Eggs	Cysts	Eggs	Cysts	<i>Pf:Pi</i> Eggs
Buster	Nemathorin 10G	11	43	1	46	0.14
Buster	Untreated	13	36	3	39	0.32
Elland	Nemathorin 10G	13	30	4	32	0.25
Elland	Untreated	13	43	7	30	0.58
Empress	Nemathorin 10G	12	36	25	55	2.11
Empress	Untreated	13	38	33	75	4.55
Iodea	Nemathorin 10G	16	37	9	38	0.56
Iodea	Untreated	13	33	7	38	0.66
Karelia	Nemathorin 10G	12	40	4	46	0.83
Karelia	Untreated	13	37	8	35	0.70
Lanorma	Nemathorin 10G	12	32	21	42	2.40
Lanorma	Untreated	13	36	28	58	3.26
Maris Peer	Nemathorin 10G	14	36	42	85	3.43
Maris Peer	Untreated	13	32	87	108	8.06
Marvel	Nemathorin 10G	15	39	24	49	2.08
Marvel	Untreated	15	48	26	52	2.22
Royal	Nemathorin 10G	10	35	10	31	1.06
Royal	Untreated	12	36	11	46	0.90
Tyson	Nemathorin 10G	12	31	39	83	3.31
Tyson	Untreated	13	41	71	121	6.02

The trial area was assessed for PCN species present before planting using an amalgamated sample. The test result indicated the species of PCN present was 100% *Globodera pallida*.

The assessment of the performance of the nematicide (fosthiazate) with regard to the multiplication of PCN in this trial is complex because of the reduction in nematode populations due to the various varietal resistances. Figure 10 indicates the nematicide has reduced multiplication when comparing the pre-planting and post-harvest populations of Maris Peer (*G. pallida* National List resistance rating = 2).

Figure 10. Cyst and Egg counts pre and post planting and Pf:Pi Ratio - Maris Peer



When comparing the performance of the nematicide with all the varieties within this trial there is an additional reduction in multiplication observed with many of the varieties, Figure 11.

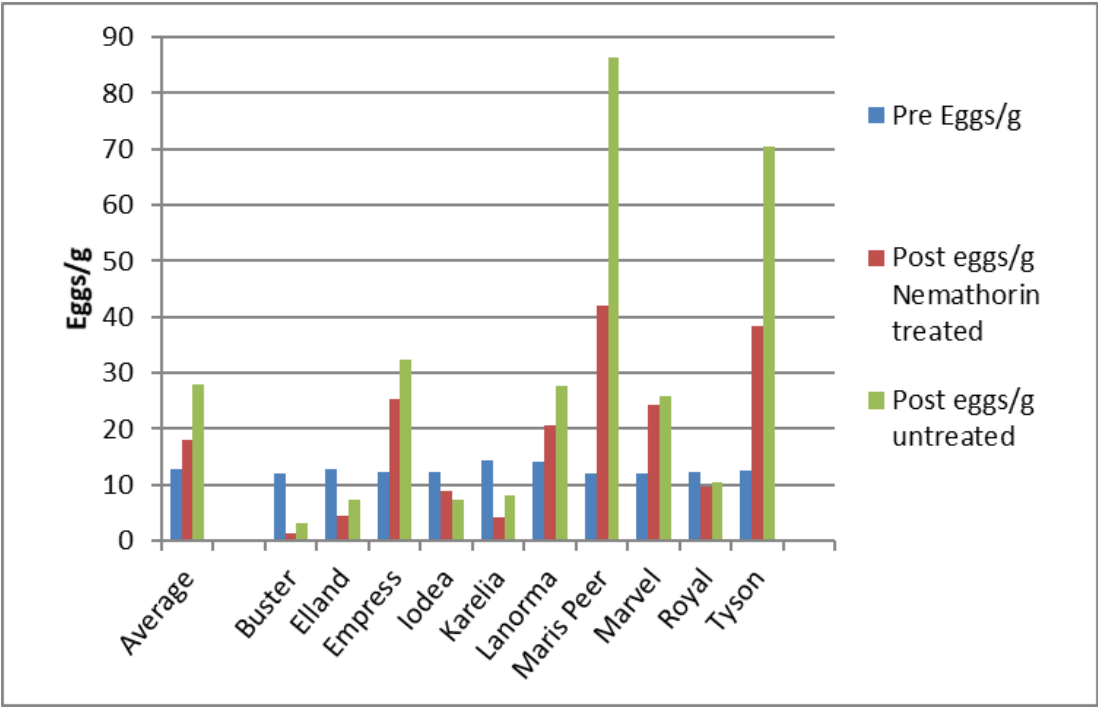


Figure 11. Cyst and Egg counts pre and post planting and Pf:Pi Ratio

Phytotoxicity

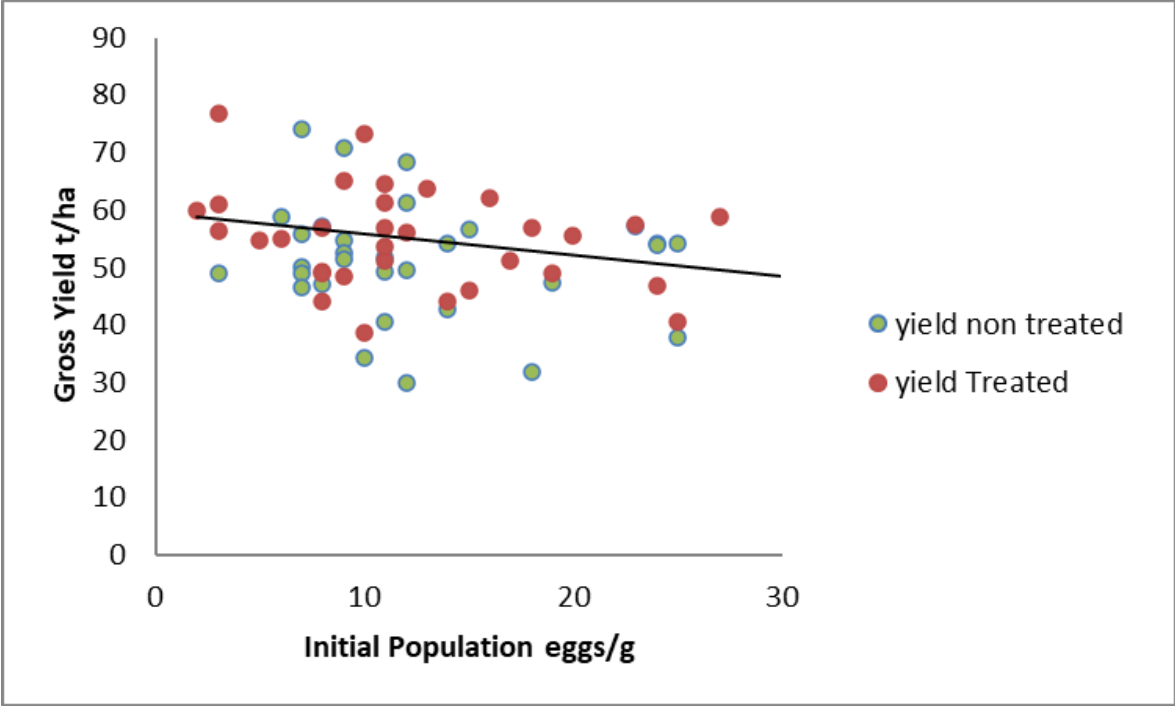
No phytotoxicity was observed in any plot throughout the duration of the trial due to nematicide treatment effects. Some yellowing was observed within the foliage of Maris Peer and Tyson, particularly in untreated plots. These effects were consistent with yellowing observed in commercial crops of these varieties when grown in PCN infected soils.

5. CONCLUSIONS AND PRACTICAL RECOMMENDATIONS

Effect of PCN – Yield T/ha and tuber number per ha

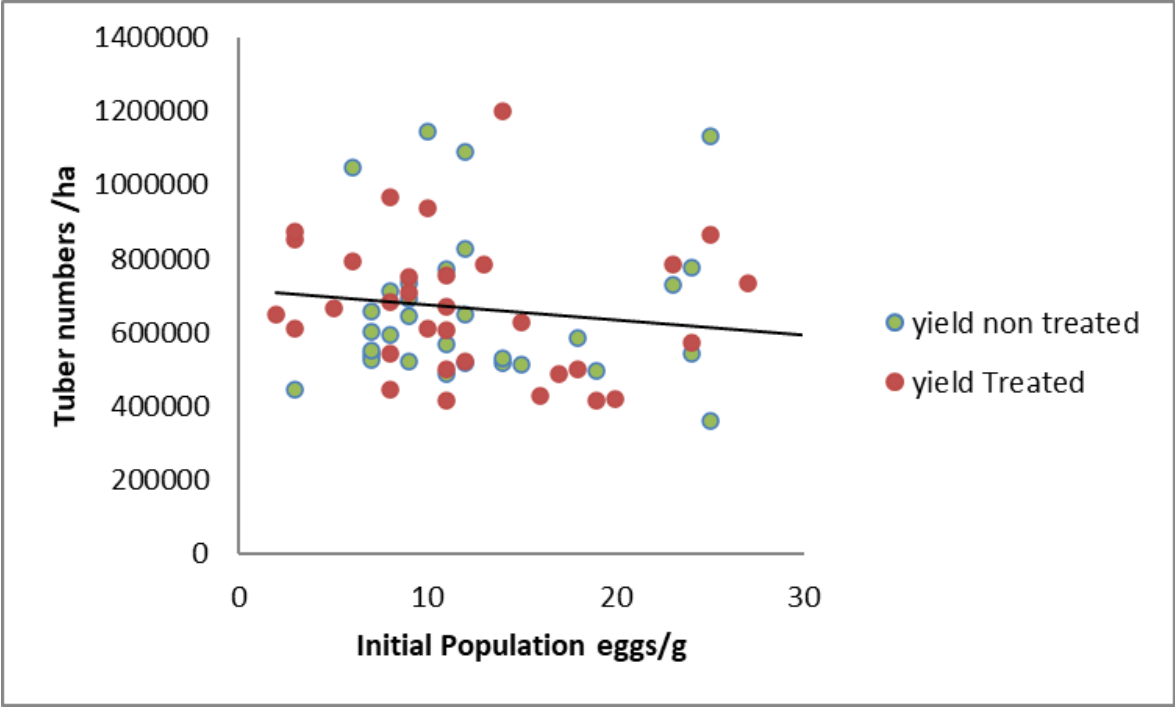
When comparing all varieties, including nematicide-treated and untreated, the effect of increasing population of PCN was to reduce yield at a relatively linear rate (Figure 12).

Figure 12. Yield Treated and untreated all varieties



Comparison of the effect on tuber numbers also revealed a reduction with increasing populations of PCN (Figure 13). However, the rate of decline for both yield and tuber population were low due to a low initial PCN populations within the trial site.

Figure 13. Tuber number/ha treated and untreated all varieties



Effect of Nematicide – Yield/PCN Multiplication

The average yield increases across all the varieties (excluding Empress and Iodea) following the application of a nematicide (fosthiazate) was 7.4 % with an increase observed with 8 varieties.

Figure 14. Comparison of varieties by yield t/ha

Comparison of average varietal yield (Treated/Untreated)		
	Nematicide-treated Yield	Untreated Yield
	Buster 65.10 t/ha	Buster 65.07 t/ha
	Royal 59.65 t/ha	Elland 57.56 t/ha
	Elland 57.67 t/ha	Lanorma 52.26 t/ha
	Lanorma 56.38 t/ha	Royal 52.23 t/ha
	Karelia 54.85 t/ha	Karelia 51.93 t/ha
	Marvel 53.30 t/ha	Marvel 50.91 t/ha
	Tyson 52.41 t/ha	Tyson 40.40 t/ha
	Maris Peer 41.92 t/ha	Maris Peer 40.32 t/ha
Average	55.16 t/ha	51.34 t/ha

When comparing the average yield of all varieties (excluding Iodea and Empress due to variable plant populations) using an Anova two factor comparison it is revealed the increase in yield due to nematicide treatment was significant. ($P < 0.05$).

Varietal Resistance to *Globodera pallida*

The varieties selected for the trial were targeted as being varieties with reported partial to near full resistance to at least one of the two PCN species. The resistance ratings from the National List testing procedure (where available) are reported in the Potato Variety Database, which is hosted by SASA.

Variety	<i>G. pallida</i> resistance rating	<i>G. rostochiensis</i> resistance rating	Market segment
Maris Peer	2	2	salad
Buster	9	9	pre-pack
Elland	9	3	Processing, pre-pack
Empress			salad
Iodea			salad
Karelia			pre-pack
Lanorma	5	9	pre-pack
Marvel	5	8	bag/processing
Royal	3	9	processing
Tyson			pre-pack

The values for the ratio of the final population of PCN eggs/g compared to the initial population (Pf:Pi ratio) within this trial were:

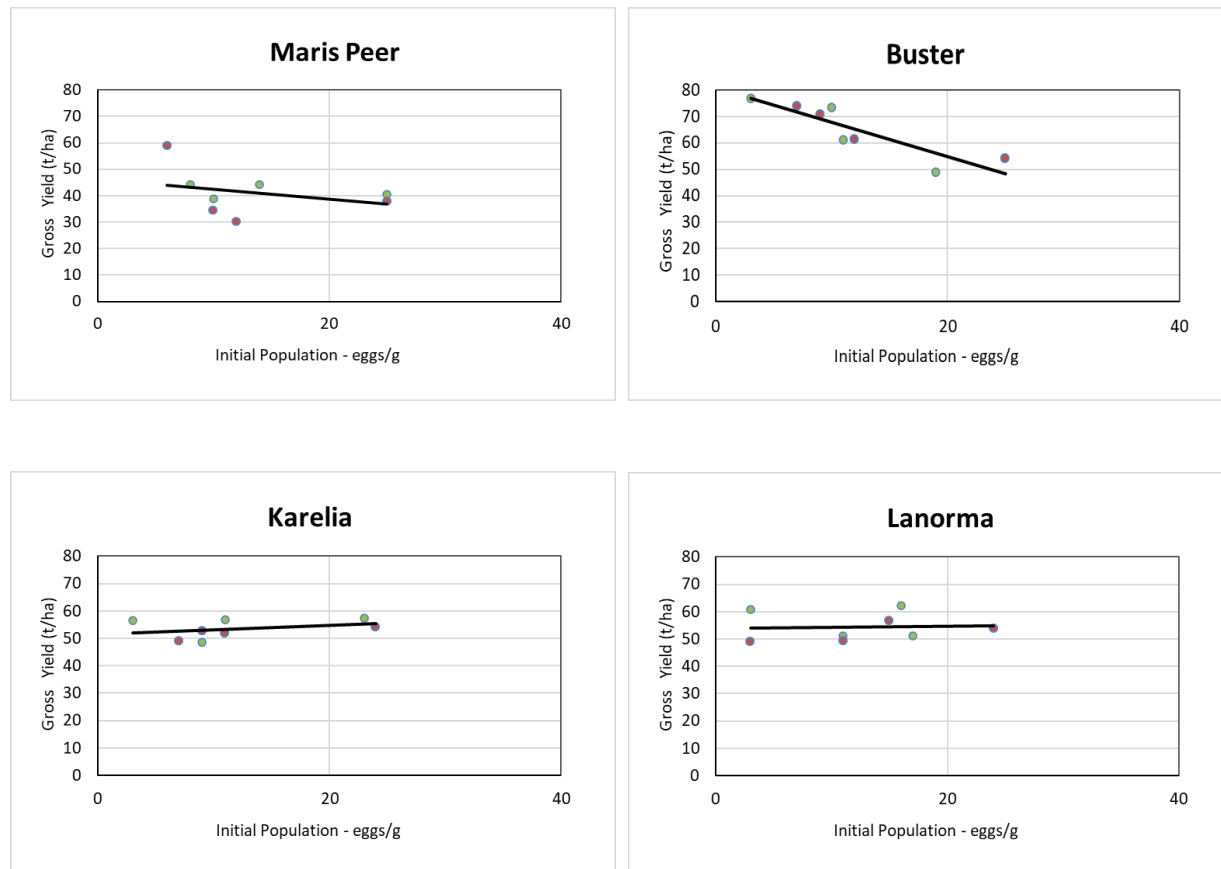
Variety	Mean Pf:Pi ratio (treated and non-treated)
Buster	0.19
Elland	0.45
Karelia	0.51
Iodea	0.58
Royal	0.92
Marvel	1.68
Lanorma	1.94
Empress	2.33
Tyson	4.45
Maris Peer	4.67

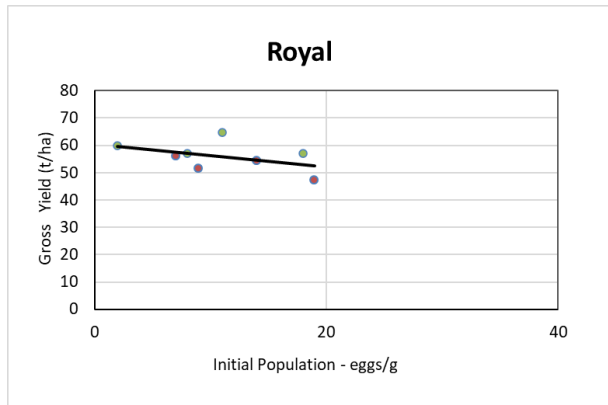
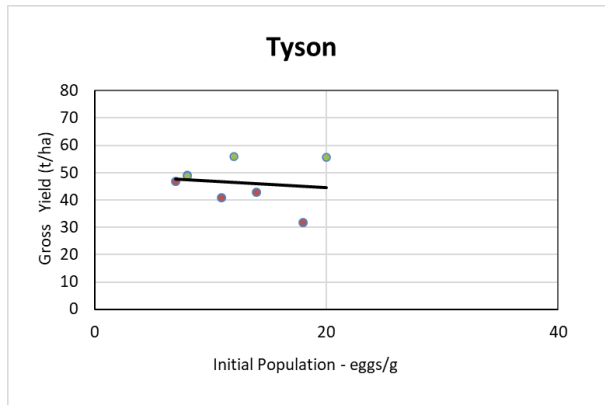
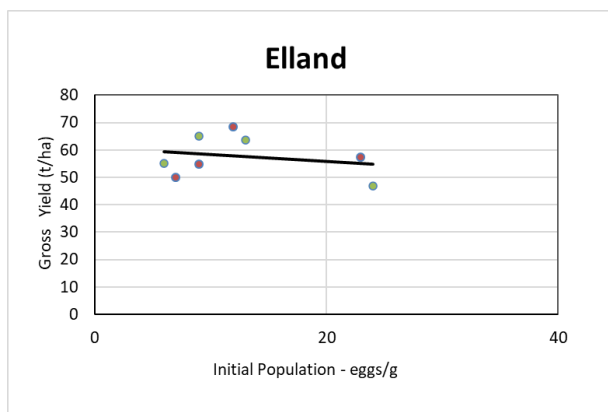
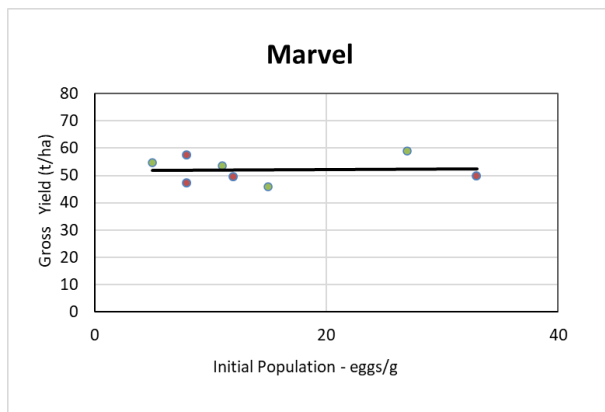
Varietal tolerance to *Globodera pallida*

The trial, with a stratified design, allowed some assessment of a variety's performance with increasing levels of PCN on the same site.

Figure 18, demonstrates the rate of yield reduction with increasing PCN levels for all varieties except Iodea and Empress (they were excluded due to variable populations within plots due to seed losses).

Figure 18. Individual rate of yield decline with increasing PCN pressure





Summary

- Significant variation in the rate of canopy growth and maximum ground cover achieved was observed between varieties. The maximum ground cover (excluding Empress and Iodea due to seed rots) of Maris Peer, Lanorma, Tyson, Karelia, Elland and Marvel was achieved on 19th July. The rate of canopy expansion of the varieties Buster and Royal was slower than anticipated and did not achieve maximum ground cover until 24th August.
- The average yield, t/ha, of all varieties (excluding Empress and Iodea due to seed rots) with fosthiazate nematicide treatment (55.16 t/ha) was significantly higher than the untreated yield 51.34 t/ha (7.4% increase).
- No significant differences in tuber numbers were observed when comparing fosthiazate nematicide treatment with untreated as an average of all varieties.
- The *Pf:Pi* ratio (eggs/g) used to compare PCN multiplication was below 1 for both fosthiazate nematicide treated and untreated plots for Buster, Iodea, Elland and Karelia.
- The *Pf:Pi* ratio (eggs/g) used to compare PCN multiplication was between 1 and 4.66 for an average of fosthiazate nematicide treated and untreated plots for Empress, Royal, Lanorma, Marvel and Tyson.
- Yields declines of all varieties with increasing levels of PCN eggs/g were relatively small, including the intolerant standard variety Maris Peer. The yield of many varieties remained stable when comparing Block 1 low initial PCN (2-8 eggs/g) to block 4 (17-33 eggs/g) – therefore it is not possible to conclude variety tolerance from the data within this trial.

6. APPENDICES

Appendix 1. Emergence Results

Trial		SPO PCN Varietal Tolerance		Harvest area (m ²):		2.745													
Protocol No:		2021 SPO11																	
Location:		Little Bealings																	
Crop:		Potatoes																	
Plot	Treatment No.	Pre PCN Block	Pre Planting Block Range	Variety	Nematocide Treatment	Plants Emerged (No.) 30/05/2021	Plants Emerged (No.) 04/06/2021	Plants Emerged (No.) 07/06/2021	Plants Emerged (No.) 14/06/2021	Plants Emerged (No.) 22/06/2021	Plants Emerged (No.) 29/06/2021	Plants Emerged (%) 30/05/2021	Plants Emerged (%) 04/06/2021	Plants Emerged (%) 07/06/2021	Plants Emerged (%) 14/06/2021	Plants Emerged (%) 22/06/2021	Plants Emerged (%) 29/06/2021		
1	17	1	2 - 8 eggs/g	Elland	Untreated	0	1	7	35	35	36	0.0	2.8	19.4	97.2	97.2	100.0		
2	7	1	2 - 8 eggs/g	Buster	Untreated	0	0	0	21	28	28	0.0	0.0	0.0	58.3	77.8	77.8		
3	7	2	11-16 eggs/g	Buster	Untreated	0	0	0	20	32	34	0.0	0.0	0.0	55.6	88.9	94.4		
4	8	2	8-11 eggs/g	Buster	Nemathorin	0	0	1	29	33	33	0.0	0.0	2.8	80.6	91.7	91.7		
5	5	3	11-16 eggs/g	Tyson	Untreated	1	20	35	36	36	36	2.8	55.6	97.2	100.0	100.0	100.0		
6	16	1	2 - 8 eggs/g	Marvel	Nemathorin	0	10	25	36	36	36	0.0	27.8	69.4	100.0	100.0	100.0		
7	14	2	8-11 eggs/g	Iodea	Nemathorin	0	4	16	18	19	19	0.0	11.1	44.4	50.0	52.8	52.8		
8	16	2	8-11 eggs/g	Elland	Nemathorin	0	1	6	35	35	36	0.0	2.8	16.7	97.2	97.2	100.0		
9	6	3	11-16 eggs/g	Tyson	Nemathorin	0	16	30	36	36	36	0.0	44.4	83.3	100.0	100.0	100.0		
10	20	3	11-16 eggs/g	Maris Peer	Nemathorin	0	17	35	35	35	36	0.0	47.2	97.2	97.2	97.2	100.0		
11	11	1	2 - 8 eggs/g	GT11TT	Untreated	0	0	6	22	22	22	0.0	0.0	16.7	61.1	61.1	61.1		
12	12	1	2 - 8 eggs/g	GT11TT	Nemathorin	0	0	2	13	15	15	0.0	0.0	5.6	36.1	41.7	41.7		
13	8	1	2 - 8 eggs/g	Buster	Nemathorin	0	0	0	24	26	26	0.0	0.0	66.7	100.0	100.0	100.0		
14	10	1	2 - 8 eggs/g	Karelia	Nemathorin	0	1	22	33	35	35	0.0	2.8	61.1	91.7	97.2	100.0		
15	6	1	2 - 8 eggs/g	Tyson	Nemathorin	-1	18	31	36	36	36	2.8	50.0	86.1	100.0	100.0	100.0		
16	16	2	8-11 eggs/g	Marvel	Nemathorin	0	9	28	35	35	36	0.0	25.0	77.8	97.2	97.2	100.0		
17	3	2	8-11 eggs/g	Lanorma	Untreated	0	0	0	34	35	36	0.0	0.0	94.4	97.2	100.0	100.0		
18	5	2	8-11 eggs/g	Tyson	Untreated	0	12	24	36	36	36	0.0	33.3	66.7	100.0	100.0	100.0		
19	9	2	8-11 eggs/g	Karelia	Untreated	0	3	20	33	33	36	0.0	8.3	55.6	91.7	91.7	100.0		
20	13	3	11-16 eggs/g	Iodea	Untreated	0	3	6	12	12	36	0.0	8.3	16.7	33.3	33.3	100.0		
21	13	1	2 - 8 eggs/g	Iodea	Untreated	0	3	10	25	25	36	0.0	8.3	27.8	69.4	69.4	100.0		
22	15	1	2 - 8 eggs/g	Marvel	Untreated	0	1	17	35	35	36	0.0	2.8	47.2	97.2	97.2	100.0		
23	4	4	17-33 eggs/g	Lanorma	Nemathorin	0	0	3	35	33	33	0.0	0.0	8.3	97.2	91.7	91.7		
24	4	2	8-11 eggs/g	Lanorma	Nemathorin	0	0	1	34	34	36	0.0	0.0	2.8	94.4	94.4	100.0		
25	20	1	2 - 8 eggs/g	Maris Peer	Nemathorin	0	14	35	36	36	36	0.0	38.9	97.2	100.0	100.0	100.0		
26	18	1	2 - 8 eggs/g	Elland	Nemathorin	0	3	11	35	36	36	0.0	8.3	30.6	97.2	100.0	100.0		
27	9	1	2 - 8 eggs/g	Karelia	Untreated	0	7	24	36	36	36	0.0	19.4	66.7	100.0	100.0	100.0		
28	19	2	8-11 eggs/g	Maris Peer	Untreated	0	5	21	36	36	36	0.0	13.9	58.3	100.0	100.0	100.0		
29	10	2	8-11 eggs/g	Karelia	Nemathorin	0	3	22	36	36	36	0.0	8.3	61.1	100.0	100.0	100.0		
30	1	1	2 - 8 eggs/g	Royal	Untreated	0	3	25	35	35	36	0.0	13.9	69.4	97.2	100.0	100.0		
31	4	1	2 - 8 eggs/g	Lanorma	Nemathorin	0	0	4	33	36	36	0.0	0.0	11.1	91.7	100.0	100.0		
32	2	2	8-11 eggs/g	Royal	Nemathorin	1	20	36	36	36	36	2.8	55.6	100.0	100.0	100.0	100.0		
33	10	3	11-16 eggs/g	Karelia	Nemathorin	0	6	23	34	36	36	0.0	16.7	63.9	94.4	100.0	100.0		
34	1	1	2 - 8 eggs/g	Royal	Untreated	0	9	29	35	36	36	0.0	25.0	80.6	97.2	100.0	100.0		
35	1	4	17-33 eggs/g	Royal	Untreated	0	9	26	33	36	36	0.0	25.0	72.2	91.7	100.0	100.0		
36	17	2	8-11 eggs/g	Elland	Untreated	0	0	17	34	36	36	0.0	0.0	47.2	94.4	100.0	100.0		
37	14	1	2 - 8 eggs/g	Iodea	Nemathorin	0	5	16	27	36	36	0.0	13.9	44.4	75.0	100.0	100.0		
38	2	1	2 - 8 eggs/g	Royal	Nemathorin	0	12	31	36	36	36	0.0	33.3	86.1	100.0	100.0	100.0		
39	3	1	2 - 8 eggs/g	Lanorma	Untreated	0	0	0	36	36	36	0.0	0.0	0.0	100.0	100.0	100.0		
40	11	2	8-11 eggs/g	GT11TT	Untreated	0	0	1	5	5	5	0.0	0.0	2.8	13.9	13.9	13.9		
41	18	3	11-16 eggs/g	Elland	Nemathorin	0	2	12	35	35	36	0.0	5.6	33.3	97.2	97.2	100.0		
42	15	3	11-16 eggs/g	Marvel	Untreated	0	5	28	36	36	36	0.0	13.9	77.8	100.0	100.0	100.0		
43	2	3	11-16 eggs/g	Royal	Nemathorin	0	11	32	35	35	36	0.0	30.6	88.9	97.2	97.2	100.0		
44	12	2	8-11 eggs/g	GT11TT	Nemathorin	0	0	1	7	9	9	0.0	0.0	2.8	19.4	25.0	25.0		
45	15	2	8-11 eggs/g	Marvel	Untreated	0	4	14	33	33	36	0.0	11.1	50.0	91.7	91.7	100.0		
46	14	3	11-16 eggs/g	Iodea	Nemathorin	0	3	14	28	28	36	0.0	8.3	38.9	77.8	77.8	100.0		
47	7	2	8-11 eggs/g	Buster	Untreated	0	0	0	15	29	29	0.0	0.0	0.0	41.7	80.6	80.6		
48	5	1	2 - 8 eggs/g	Tyson	Untreated	0	14	32	34	34	36	0.0	38.9	88.9	94.4	94.4	100.0		
49	19	1	2 - 8 eggs/g	Maris Peer	Untreated	0	6	25	36	36	36	0.0	16.7	69.4	100.0	100.0	100.0		
50	17	3	11-16 eggs/g	Elland	Untreated	0	2	12	33	33	36	0.0	5.6	33.3	91.7	91.7	100.0		
51	9	4	17-33 eggs/g	Karelia	Untreated	0	7	23	35	35	36	0.0	19.4	63.9	97.2	97.2	100.0		
52	16	4	17-33 eggs/g	Marvel	Nemathorin	0	14	29	36	36	36	0.0	38.9	80.6	100.0	100.0	100.0		
53	10	4	17-33 eggs/g	Karelia	Nemathorin	0	10	25	36	36	36	0.0	27.8	69.4	100.0	100.0	100.0		
54	4	2	11-16 eggs/g	Lanorma	Nemathorin	0	0	1	34	36	36	0.0	0.0	2.8	94.4	100.0	100.0		
55	11	4	17-33 eggs/g	GT11TT	Untreated	0	0	2	14	15	36	0.0	0.0	5.6	38.9	41.7	100.0		
56	17	4	17-33 eggs/g	Elland	Untreated	0	1	10	36	36	36	0.0	2.8	27.8	100.0	100.0	100.0		
57	3	4	17-33 eggs/g	Lanorma	Untreated	0	0	8	33	35	36	0.0	0.0	22.2	91.7	97.2	100.0		
58	18	4	17-33 eggs/g	Elland	Nemathorin	0	1	9	35	35	36	0.0	2.8	25.0	97.2	97.2	100.0		
59	2	4	17-33 eggs/g	Royal	Nemathorin	0	10	28	36	36	36	0.0	27.8	77.8	100.0	100.0	100.0		
60	14	4	17-33 eggs/g	Iodea	Nemathorin	0	2	6	12	13	13	0.0	5.6	16.7	33.3	36.1	36.1		
61	20	2	8-11 eggs/g	Maris Peer	Nemathorin	0	11	36	36	36	36	0.0	30.6	100.0	100.0	100.0	100.0		
62	5	4	17-33 eggs/g	Tyson	Untreated	0	16	31	36	36	36	0.0	44.4	86.1	100.0	100.0	100.0		
63	8	3	11-16 eggs/g	Buster	Nemathorin	0	0	0	20	25	25	0.0	0.0	0.0	55.6	69.4	69.4		
64	6	4	17-33 eggs/g	Tyson	Nemathorin	0	15	28	36	36	36	0.0	41.7	77.8	100.0	100.0	100.0		
65	13	2	8-11 eggs/g	Iodea	Untreated	0	0	2	10	11	11	0.0	0.0	5.6	27.8	30.6	30.6		
66	9	3	11-16 eggs/g	Karelia	Untreated	0	9	31	36	36	36	0.0	25.0	86.1	100.0	100.0	100.0		
67	16	3	11-16 eggs/g	Marvel	Nemathorin	0	10	28	36	36	36	0.0	27.8	77.8	100.0	100.0	100.0		
68	19	3	11-16 eggs/g	Maris Peer	Untreated	0	10	25	36	36	36	0.0	27.8	69.4	100.0	100.0	100.0		
69	19	4	17-33 eggs/g	Maris Peer	Untreated	0	4	25	36	36	36	0.0	11.1	69.4	100.0	100.0	100.0		
70	11	3	11-16 eggs/g	GT11TT	Untreated	0	0	1	7	8	9	0.0	0.0	2.8	19.4	22.2	25.0		
71	1	3	11-16 eggs/g	Royal	Untreated	0	16	34	36	36	36	0.0	44.4	94.4	100.0	100.0	100.0		
72	15	4	17-33 eggs/g	Marvel	Untreated	0	8	27	35	35	36	0.0	22.2	75.0	97.2	97.2	100.0		
73	13	4	17-33 eggs/g	Iodea	Untreated	0	0	5	21	21	36	0.0	0.0	13.9	58.3	58.3	100.0		
74	20	4	17-33 eggs/g	Maris Peer	Nemathorin	0	3	22	36	36	36	0.0	8.3	61.1	100.0	100.0	100.0		
75	12	3	11-16 eggs/g	GT11TT	Nemathorin	0	0	2	7	7	7	0.0	0.0	5.6	19.4	19.4	19.4		
76	12	4	17-33 eggs/g	GT11TT	Nemathorin	0	0	5	19	20	31	0.0	0.0	13.9	52.8	55.6	86.1		
77	7	4	17-33 eggs/g	Buster	Untreated	0	0	0	23	33	33	0.0	0.0	0.0	63.9	91.7	91.7		
78	8	4	17-33 eggs/g	Buster	Nemathorin	0	0	1	32	34	34	0.0	0.0	2.8	88.9	94.4	94.4		
79	3	3	11-16 eggs/g	Lanorma	Untreated	0	0	3	34	36	36	0.0	0.0	8.3	94.4	100.0	100.0		
80	6	2	8-11 eggs/g	Tyson	Nemathorin	0	11	26	34	36	36	0.0	30.6						

Appendix 2. Ground Cover results

Trial: SPO PCN Varietal Tolerance													
Protocol No: 2021 SPO11		Harvest area (m ²):											
Location: Little Bealings													
Crop: Potatoes													
Plot	Treatment No.	Pre PCN Block	Pre Planting Block Range	Variety	Nematocide Treatment	Foliar Ground Cover (%) 14/06/2021	Foliar Ground Cover (%) 22/06/2021	Foliar Ground Cover (%) 29/06/2021	Foliar Ground Cover (%) 05/07/2021	Foliar Ground Cover (%) 12/07/2021	Foliar Ground Cover (%) 19/07/2021	Foliar Ground Cover (%) 24/08/2021	Foliar Ground Cover (%) 30/08/2021
1	17	1	2 - 8 eggs/g	Elland	Untreated	5	25	41	46	58	64	91	85
2	7	1	2 - 8 eggs/g	Buster	Untreated	1	21	32	42	46	52	100	100
3	7	3	11-16 eggs/g	Buster	Untreated	2	24	38	46	51	65	100	100
4	8	2	8-11 eggs/g	Buster	Nemathorin	5	29	48	53	81	85	100	100
5	5	3	11-16 eggs/g	Tyson	Untreated	21	49	63	95	100	100	21	11
6	16	1	2 - 8 eggs/g	Marvel	Nemathorin	14	39	55	79	92	100	89	61
7	14	2	8-11 eggs/g	Iodea	Nemathorin	10	18	29	72	72	75	47	25
8	18	2	8-11 eggs/g	Elland	Nemathorin	10	36	59	76	94	100	98	80
9	6	3	11-16 eggs/g	Tyson	Nemathorin	17	48	65	96	96	100	73	25
10	20	3	11-16 eggs/g	Maris Peer	Nemathorin	21	51	82	100	100	100	3	0
11	11	1	2 - 8 eggs/g	GT11TT	Untreated	4	10	28	41	60	64	97	52
12	12	1	2 - 8 eggs/g	GT11TT	Nemathorin	2	10	27	48	61	69	92	62
13	8	1	2 - 8 eggs/g	Buster	Nemathorin	3	18	37	47	58	65	100	100
14	10	1	2 - 8 eggs/g	Karelia	Nemathorin	12	41	68	88	100	100	96	73
15	6	1	2 - 8 eggs/g	Tyson	Nemathorin	23	45	59	96	100	100	43	12
16	16	2	8-11 eggs/g	Marvel	Nemathorin	11	39	54	71	100	100	82	54
17	3	2	8-11 eggs/g	Lanorma	Untreated	13	23	39	65	71	94	82	55
18	5	2	8-11 eggs/g	Tyson	Untreated	17	38	48	72	88	90	5	22
19	9	2	8-11 eggs/g	Karelia	Untreated	12	47	56	71	92	100	97	85
20	13	3	11-16 eggs/g	Iodea	Untreated	5	10	17	25	47	47	6	5
21	13	1	2 - 8 eggs/g	Iodea	Untreated	4	18	29	45	47	58	17	5
22	15	1	2 - 8 eggs/g	Marvel	Untreated	14	47	63	82	97	100	59	31
23	4	4	17-33 eggs/g	Lanorma	Nemathorin	10	31	54	75	94	100	61	34
24	4	2	8-11 eggs/g	Lanorma	Nemathorin	7	33	55	84	100	100	60	27
25	20	1	2 - 8 eggs/g	Maris Peer	Nemathorin	24	46	74	100	100	100	5	0
26	18	1	2 - 8 eggs/g	Elland	Nemathorin	7	34	52	74	74	86	87	46
27	9	1	2 - 8 eggs/g	Karelia	Untreated	20	42	54	88	95	100	97	50
28	19	2	8-11 eggs/g	Maris Peer	Untreated	12	37	60	69	100	100	3	0
29	10	2	8-11 eggs/g	Karelia	Nemathorin	12	41	61	78	93	100	98	68
30	11	2	8-11 eggs/g	Royal	Untreated	21	39	57	62	71	85	97	86
31	4	1	2 - 8 eggs/g	Lanorma	Nemathorin	12	35	53	72	91	100	51	27
32	2	2	8-11 eggs/g	Royal	Nemathorin	23	43	67	81	96	100	98	85
33	10	3	11-16 eggs/g	Karelia	Nemathorin	10	34	54	74	100	100	99	73
34	1	1	2 - 8 eggs/g	Royal	Untreated	18	43	59	74	92	98	97	84
35	1	4	17-33 eggs/g	Royal	Untreated	22	48	58	63	79	85	81	75
36	17	2	8-11 eggs/g	Elland	Untreated	10	36	46	67	75	85	67	45
37	14	1	2 - 8 eggs/g	Iodea	Nemathorin	8	22	37	68	71	78	57	31
38	2	1	2 - 8 eggs/g	Royal	Nemathorin	22	46	65	80	95	100	100	95
39	3	1	2 - 8 eggs/g	Lanorma	Untreated	6	37	55	69	100	100	81	53
40	11	2	8-11 eggs/g	GT11TT	Untreated	5	10	21	48	58	60	47	39
41	18	3	11-16 eggs/g	Elland	Nemathorin	9	34	53	62	72	87	95	58
42	15	3	11-16 eggs/g	Marvel	Untreated	24	45	64	88	95	100	87	51
43	2	3	11-16 eggs/g	Royal	Nemathorin	18	43	54	74	78	92	98	86
44	12	2	8-11 eggs/g	GT11TT	Nemathorin	4	8	19	34	43	59	87	69
45	15	2	8-11 eggs/g	Marvel	Untreated	19	39	64	100	100	100	79	52
46	14	3	11-16 eggs/g	Iodea	Nemathorin	7	27	51	52	58	60	44	29
47	7	2	8-11 eggs/g	Buster	Untreated	5	18	37	56	48	57	100	95
48	5	1	2 - 8 eggs/g	Tyson	Untreated	14	36	58	90	100	100	47	15
49	19	1	2 - 8 eggs/g	Maris Peer	Untreated	11	39	56	82	100	100	17	5
50	17	3	11-16 eggs/g	Elland	Untreated	13	35	51	82	100	100	83	68
51	9	4	17-33 eggs/g	Karelia	Untreated	12	31	47	66	83	88	91	83
52	16	4	17-33 eggs/g	Marvel	Nemathorin	25	56	82	100	100	100	87	71
53	10	4	17-33 eggs/g	Karelia	Nemathorin	11	36	51	75	81	100	100	97
54	4	3	11-16 eggs/g	Lanorma	Nemathorin	8	35	55	81	100	100	92	59
55	11	4	17-33 eggs/g	GT11TT	Untreated	4	10	17	35	48	65	77	72
56	17	4	17-33 eggs/g	Elland	Untreated	7	29	48	67	78	82	75	71
57	3	4	17-33 eggs/g	Lanorma	Untreated	13	36	51	69	79	86	81	65
58	18	4	17-33 eggs/g	Elland	Nemathorin	10	37	58	74	75	95	96	84
59	2	4	17-33 eggs/g	Royal	Nemathorin	13	38	61	86	93	100	97	92
60	14	4	17-33 eggs/g	Iodea	Nemathorin	5	12	21	41	52	56	51	23
61	20	2	8-11 eggs/g	Maris Peer	Nemathorin	21	37	46	94	100	100	9	0
62	5	4	17-33 eggs/g	Tyson	Untreated	18	39	53	64	64	62	16	5
63	8	3	11-16 eggs/g	Buster	Nemathorin	3	15	35	46	49	57	100	100
64	6	4	17-33 eggs/g	Tyson	Nemathorin	13	39	55	84	95	100	49	36
65	13	2	8-11 eggs/g	Iodea	Untreated	4	13	24	38	41	45	11	0
66	9	3	11-16 eggs/g	Karelia	Untreated	14	31	44	58	71	77	88	61
67	16	3	11-16 eggs/g	Marvel	Nemathorin	29	53	80	96	100	100	81	54
68	19	3	11-16 eggs/g	Maris Peer	Untreated	13	35	53	84	92	100	1	0
69	19	4	17-33 eggs/g	Maris Peer	Untreated	12	36	54	72	76	100	3	0
70	11	3	11-16 eggs/g	GT11TT	Untreated	5	10	21	39	53	61	41	20
71	1	3	11-16 eggs/g	Royal	Untreated	20	36	48	67	70	85	97	90
72	15	4	17-33 eggs/g	Marvel	Untreated	23	49	63	84	92	100	64	47
73	13	4	17-33 eggs/g	Iodea	Untreated	9	23	41	49	43	45	11	5
74	20	4	17-33 eggs/g	Maris Peer	Nemathorin	12	34	57	85	100	100	16	0
75	12	3	11-16 eggs/g	GT11TT	Nemathorin	3	8	22	39	44	55	71	21
76	12	4	17-33 eggs/g	GT11TT	Nemathorin	8	15	31	67	76	80	63	52
77	7	4	17-33 eggs/g	Buster	Untreated	4	18	34	41	44	59	94	90
78	8	4	17-33 eggs/g	Buster	Nemathorin	6	23	31	46	54	61	100	95
79	3	3	11-16 eggs/g	Lanorma	Untreated	11	35	40	56	77	100	66	52
80	6	2	8-11 eggs/g	Tyson	Nemathorin	20	41	62	81	100	100	61	31
Assessed By:						B.Lawrence	B.Lawrence	B.Lawrence	B.Lawrence	B.Lawrence	B.Lawrence	B.Lawrence	B.Lawrence
Date:						14/06/2021	22/06/2021	29/06/2021	05/07/2021	12/07/2021	19/07/2021	24/08/2021	30/08/2021
Growth Stage (Mean):													
Growth Stage (Min):													
Growth Stage (Max):													

Appendix 4. Yield and PCN population counts Pi and Pf

Trial: SPO PCN Varietal Tolerance												
Protocol No:		2021 SPO11		Harvest area (m ²):		2.745						
Location:		Little Bealings										
Crop:		Potatoes										
Plot	Treatment No.	Pre PCN Block	Pre Planting Block Range	Variety	Nematicide Treatment	Total Cysts (No./200g soil) Post Harvest	Dead Cysts (No./200g soil) Post Harvest	Half Full (No./200g soil) Post Harvest	Full Cysts (No./200g soil) Post Harvest	PCN Eggs (No./g soil) Post Harvest	PCN Eggs (No./g soil) Pre Planting	PCN Eggs Pf:Pi
1	17	1	2 - 8 eggs/g	Elland	Untreated	22	20	0	2	2	7	0.3
2	7	1	2 - 8 eggs/g	Buster	Untreated	31	27	0	4	2	7	0.3
3	7	3	11-16 eggs/g	Buster	Untreated	40	40	0	0	0	12	0.0
4	8	2	8-11 eggs/g	Buster	Nemathorin	57	47	7	3	2	10	0.2
5	5	3	11-16 eggs/g	Tyson	Untreated	120	40	10	70	75	14	5.4
6	16	1	2 - 8 eggs/g	Marvel	Nemathorin	29	20	2	7	8	5	1.6
7	14	2	8-11 eggs/g	Iodea	Nemathorin	28	21	2	5	3	11	0.3
8	18	2	8-11 eggs/g	Elland	Nemathorin	42	40	0	2	2	9	0.2
9	6	3	11-16 eggs/g	Tyson	Nemathorin	98	51	10	37	31	12	2.6
10	20	3	11-16 eggs/g	Maris Peer	Nemathorin	100	22	4	74	73	14	5.2
11	11	1	2 - 8 eggs/g	GT11TT	Untreated	93	25	20	48	34	3	11.3
12	12	1	2 - 8 eggs/g	GT11TT	Nemathorin	39	17	5	17	15	5	3.0
13	8	1	2 - 8 eggs/g	Buster	Nemathorin	30	26	3	1	0.35	3	0.1
14	10	1	2 - 8 eggs/g	Karelia	Nemathorin	38	30	3	5	8	3	2.7
15	6	1	2 - 8 eggs/g	Tyson	Nemathorin	76	30	6	40	38	8	4.8
16	16	2	8-11 eggs/g	Marvel	Nemathorin	76	24	15	37	54	11	4.9
17	3	2	8-11 eggs/g	Lanorma	Untreated	50	15	3	32	31	11	2.8
18	5	2	8-11 eggs/g	Tyson	Untreated	116	18	12	86	69	11	6.3
19	9	2	8-11 eggs/g	Karelia	Untreated	30	21	3	6	6	9	0.7
20	13	3	11-16 eggs/g	Iodea	Untreated	40	27	6	7	11	12	0.9
21	13	1	2 - 8 eggs/g	Iodea	Untreated	22	14	2	6	6	6	1.0
22	15	1	2 - 8 eggs/g	Marvel	Untreated	64	28	12	24	32	8	4.0
23	4	4	17-33 eggs/g	Lanorma	Nemathorin	42	23	3	16	20	17	1.2
24	4	2	8-11 eggs/g	Lanorma	Nemathorin	44	22	4	18	25	11	2.3
25	20	1	2 - 8 eggs/g	Maris Peer	Nemathorin	83	45	13	25	29	8	3.6
26	18	1	2 - 8 eggs/g	Elland	Nemathorin	12	10	1	1	0.45	6	0.1
27	9	1	2 - 8 eggs/g	Karelia	Untreated	28	25	0	3	3	7	0.4
28	19	2	8-11 eggs/g	Maris Peer	Untreated	88	5	9	74	95	10	9.5
29	10	2	8-11 eggs/g	Karelia	Nemathorin	30	24	4	2	2	9	0.2
30	1	2	8-11 eggs/g	Royal	Untreated	38	18	6	14	14	9	1.6
31	4	1	2 - 8 eggs/g	Lanorma	Nemathorin	38	19	2	17	14	3	4.7
32	2	2	8-11 eggs/g	Royal	Nemathorin	29	17	2	10	13	8	1.6
33	10	3	11-16 eggs/g	Karelia	Nemathorin	30	27	0	3	3	11	0.3
34	1	1	2 - 8 eggs/g	Royal	Untreated	36	31	1	4	3	7	0.4
35	1	4	17-33 eggs/g	Royal	Untreated	30	22	1	7	8	19	0.4
36	17	2	8-11 eggs/g	Elland	Untreated	31	17	5	9	7	9	0.8
37	14	1	2 - 8 eggs/g	Iodea	Nemathorin	30	25	1	4	4	7	0.6
38	2	1	2 - 8 eggs/g	Royal	Nemathorin	22	17	1	4	2	2	1.0
39	3	1	2 - 8 eggs/g	Lanorma	Untreated	39	19	2	18	21	3	7.0
40	11	2	8-11 eggs/g	GT11TT	Untreated	48	25	8	15	19	10	1.9
41	18	3	11-16 eggs/g	Elland	Nemathorin	31	22	6	3	2	13	0.2
42	15	3	11-16 eggs/g	Marvel	Untreated	59	22	4	33	30	12	2.5
43	2	3	11-16 eggs/g	Royal	Nemathorin	30	22	2	6	8	11	0.7
44	12	2	8-11 eggs/g	GT11TT	Nemathorin	40	26	3	11	9	8	1.1
45	15	2	8-11 eggs/g	Marvel	Untreated	35	15	2	18	12	8	1.5
46	14	3	11-16 eggs/g	Iodea	Nemathorin	37	20	4	13	13	15	0.9
47	7	2	8-11 eggs/g	Buster	Untreated	36	20	9	7	8	9	0.9
48	5	1	2 - 8 eggs/g	Tyson	Untreated	125	83	15	27	55	7	7.9
49	19	1	2 - 8 eggs/g	Maris Peer	Untreated	90	38	14	38	59	6	9.8
50	17	3	11-16 eggs/g	Elland	Untreated	32	13	7	12	10	12	0.8
51	9	4	17-33 eggs/g	Karelia	Untreated	44	34	4	6	8	24	0.3
52	16	4	17-33 eggs/g	Marvel	Nemathorin	44	26	3	15	17	27	0.6
53	10	4	17-33 eggs/g	Karelia	Nemathorin	87	75	9	3	4	23	0.2
54	4	3	11-16 eggs/g	Lanorma	Nemathorin	42	28	2	12	24	16	1.5
55	11	4	17-33 eggs/g	GT11TT	Untreated	66	30	4	32	31	27	1.1
56	17	4	17-33 eggs/g	Elland	Untreated	33	22	3	8	10	23	0.4
57	3	4	17-33 eggs/g	Lanorma	Untreated	78	39	8	31	27	24	1.1
58	18	4	17-33 eggs/g	Elland	Nemathorin	41	24	3	14	13	24	0.5
59	2	4	17-33 eggs/g	Royal	Nemathorin	41	21	4	16	16	18	0.9
60	14	4	17-33 eggs/g	Iodea	Nemathorin	56	35	8	13	16	30	0.5
61	20	2	8-11 eggs/g	Maris Peer	Nemathorin	89	41	11	37	38	10	3.8
62	5	4	17-33 eggs/g	Tyson	Untreated	121	60	10	51	83	18	4.6
63	8	3	11-16 eggs/g	Buster	Nemathorin	40	35	3	2	2	11	0.2
64	6	4	17-33 eggs/g	Tyson	Nemathorin	121	19	32	70	63	20	3.2
65	13	2	8-11 eggs/g	Iodea	Untreated	41	36	1	4	3	9	0.3
66	9	3	11-16 eggs/g	Karelia	Untreated	37	25	3	9	15	11	1.4
67	16	3	11-16 eggs/g	Marvel	Nemathorin	45	20	8	17	18	15	1.2
68	19	3	11-16 eggs/g	Maris Peer	Untreated	142	28	3	111	121	12	10.1
69	19	4	17-33 eggs/g	Maris Peer	Untreated	113	27	16	70	71	25	2.8
70	11	3	11-16 eggs/g	GT11TT	Untreated	93	24	9	60	46	12	3.8
71	1	3	11-16 eggs/g	Royal	Untreated	79	49	9	21	17	14	1.2
72	15	4	17-33 eggs/g	Marvel	Untreated	48	11	8	29	29	33	0.9
73	13	4	17-33 eggs/g	Iodea	Untreated	49	36	4	9	9	23	0.4
74	20	4	17-33 eggs/g	Maris Peer	Nemathorin	69	35	4	30	28	25	1.1
75	12	3	11-16 eggs/g	GT11TT	Nemathorin	40	18	4	18	18	15	1.2
76	12	4	17-33 eggs/g	GT11TT	Nemathorin	101	47	18	36	59	19	3.1
77	7	4	17-33 eggs/g	Buster	Untreated	47	42	2	3	3	25	0.1
78	8	4	17-33 eggs/g	Buster	Nemathorin	58	52	5	1	1	19	0.1
79	3	3	11-16 eggs/g	Lanorma	Untreated	63	29	6	28	32	15	2.1
80	6	2	8-11 eggs/g	Tyson	Nemathorin	38	16	5	17	22	8	2.8
Assessed By:						ASA	ASA	ASA	ASA	ASA	ASA	Calculated
Date:												
Growth Stage (Mean):												
Growth Stage (Min):												
Growth Stage (Max):												

Appendix 5. Fertiliser application details

	Soil Index	Fertiliser Application	Notes
N		230	Split - pre plant/pre em/TI
P	3	50	
K	2-	360	
Mg	2	40	

7. ACKNOWLEDGEMENTS

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