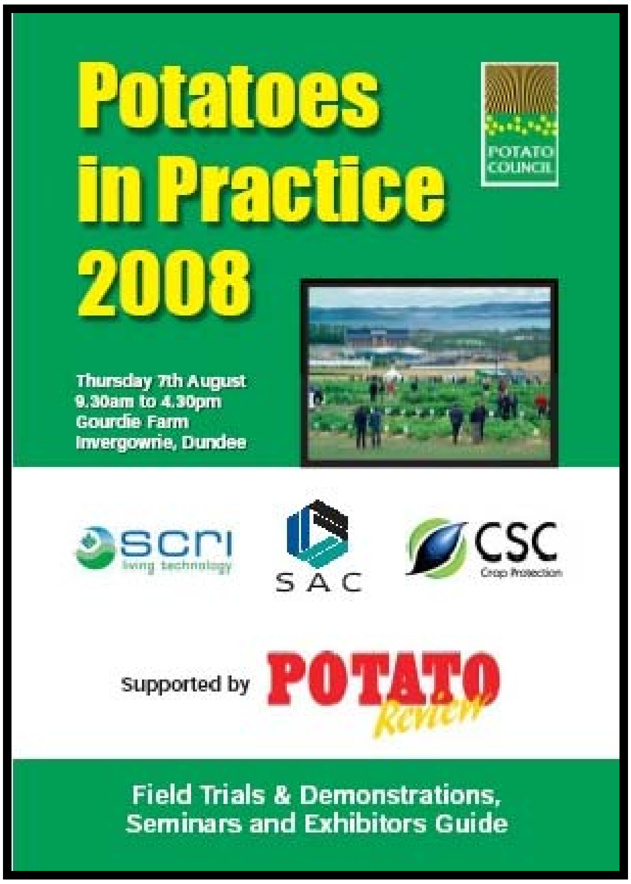


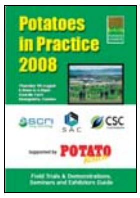
FIELD TRIALS & DEMOSTRATIONS
RESULTS SUMMARY

March 2009

POTATOES IN PRACTICE 2008

FIELD TRIALS & DEMONSTRATIONS RESULTS SUMMARY

March 2009



Trials and Demonstration Results Guide

This guide has been produced to ensure visitors that attended the event are able to find out further information on trials and demonstrations that took place at the 2008 Potatoes in Practice Event.

SCRI, SAC, CSC PotatoCare and the Potato Council hosted the 2008 ‘Potatoes in Practice’ event in Dundee. This is now the largest annual potato knowledge transfer event in Britain, with a record 750 visitors in 2008.
The event is a unique opportunity for farmers, advisors and others to view government and industry supported research and new developments at a single site.

How to use this guide

In order to maintain consistency, we followed the same layout as the Event Guide 2008. Below the title of each trial or demonstration, we have added – where available – the results.

If you have any questions regarding a specific trial or demonstration, please contact the relevant person responsible for it.

Date for your Diary

Potatoes in Practice 2009 will take place in a NEW location: Balruddery Farm, near Dundee.
For more details, www.potato.org.uk/pip

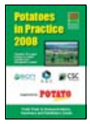
Principal organisers

SCRI: Sarah Collier (Information Services Manager), Euan Caldwell (Farm Manager), Dr Finlay Dale (Research Scientist)

SAC: Dr. Stuart Wale (Head of Crop Services)

Potato Council: Val Crowder / Mark Prentice (Seed & Export)

CSC: Jim Rennie (Technical Director), Colin Rennie (Agronomist), David Barclay (Cropcare Agronomist)



Contents

1- SCRI

Variation in drought tolerance in potatoes

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Introduction

The impact of global environmental change on the sustainability of potato production is unknown, but the predicted hotter drier summers mean that potato cultivars that are more efficient at capturing water will be required to maintain current yields. Plants which have large root-soil interfaces (e.g. longer thinner roots, more root hairs or symbiotic relationships with mycorrhizae) are likely to be more efficient in capturing resources, including water. Our research has focused on using genetically well defined populations of potatoes to elucidate genotypic variation in root traits in plants grown in the field. Our experiments have demonstrated meaningful genotypic variation in a range of root traits important for improved resource capture including root length and mycorrhizal symbiosis. The aim of this demonstration was to assess whether such variation is translated into useful variation in drought tolerance.

Results

The demonstration plots show that there are large differences in drought tolerance between genotypes. In order to ascertain whether root length has any bearing on the ability of different cultivars to tolerate drought we grew a range of cultivars, with differing associated root length, under polytunnels for 14 weeks and irrigated one plot to sufficiency and left the other plot to become droughted (Figure 1). We also included some cultivars considered drought tolerant and drought susceptible from the European Cultivated Potato Database (ECPD).

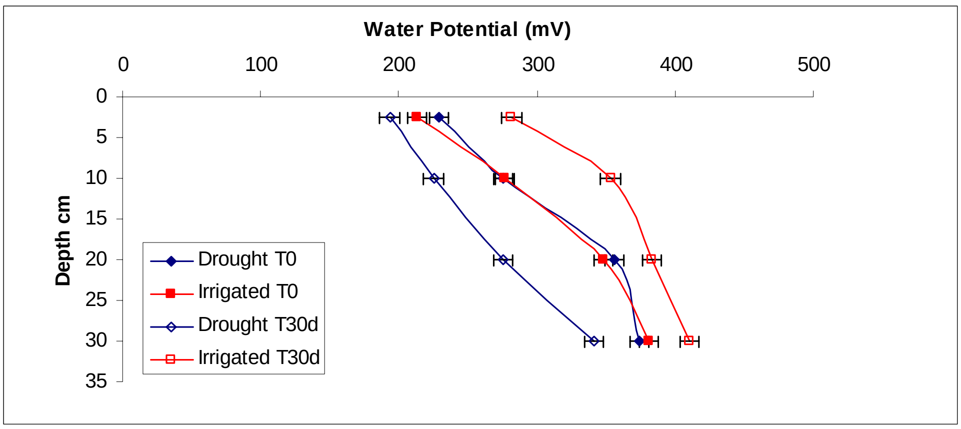

Figure 1. Distribution of water potential with depth in the profile of the treatment plots at the start of the experiment (T0) and after 30 days (T30d) of either sufficient irrigation or drought (water potential of 300 is considered sufficient for unlimited potato growth).

The demonstration plots showed that there were differences in drought tolerance between genotypes which had differing associated root lengths (Table 1). Varieties with longer roots (Cara, Desiree) were drought tolerant, while varieties with shorter roots (Maris Piper, Pentland Dell, Sarpo Mira) were drought susceptible. However, many of the character states predicted from the ECPD were not demonstrated here, e.g. King Edward, Maris Bard and Russett Burbank all showed contrary phenotypes.

Table 1: Yield of plots of a range of cultivars grown under drought and irrigated conditions and the drought tolerance/susceptibility characteristic displayed.

Cultivar	Predicted Character	Yield (kg) Irrigated	Yield (kg) Droughted	% Irrigated Growth	Observed Character [1.]
	Known root length				
Cara	Long Roots	15.9	17.5	110	Tolerant
Desiree	Long Roots	13.7	12.5	92	Tolerant
Maris Piper	Short Roots	17.4	13.9	80	Susceptible
Pentland Dell	Short Roots	8.5	7.5	88	Susceptible
Sarpo Mira	Short Roots	18.5	15.4	83	Susceptible
	ECPD description				
Kennebec	Drought Tolerant	12.6	13.3	106	Tolerant
Maris Bard	Drought Tolerant	11.8	8.8	74	Susceptible
Vales Everest	Drought Tolerant	16.1	14.9	93	Tolerant
King Edward	Drought Susceptible	17.2	15.7	91	Tolerant
Russet Burbank	Drought Susceptible	10.6	13.0	124	Tolerant
Sante	Drought Susceptible	28.9	22.8	79	Susceptible
Saturna	Drought Susceptible	10.6	8.8	83	Susceptible

[1.] *90% of irrigated growth yield was taken as an arbitrary value to discriminate water responsive and unresponsive genotypes*

Conclusion

The results from this demonstration plot have shown that potato cultivars with longer root systems are more responsive to applied water when soil moisture was in the range to be limiting yield. The anomalies between ECPD observations on drought tolerance and results in 2008 could indicate alternative mechanisms that come into play in truly droughted situations. In the future, our research will aim to identify the genetic control of rooting traits and establish whether increased root length is consistently involved in improved capture of water and nutrients. This will allow us to identify useful cultivars from current sources or inform breeding programmes and biotechnological approaches to produce more water efficient cultivars of potato for the future.

2 - SAC

Best practice for the control of powdery scab 2008

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Introduction

As part of RERAD's (Rural and Environment Research and Analysis Directorate) continuing KT in relation to their R&D funding of potato research, SAC have carried out a series of best practice demonstrations at PIP. In 2008, best practice for the control of powdery scab was selected. A document summarising powdery scab control has been published and is available on the SAC website at http://www.sac.ac.uk/consultancy/services/c-e/crops/agronomy/potatoes/potatogrowers/ .
To demonstrate the practical aspects of control, especially the use of chemical control measures, unreplicated plots were established of three control measures plus an untreated. These were applied to stocks of Estima (powdery scab resistance rating – 3) and Marfona (powdery scab resistance rating – 5) which were either showing symptoms of powdery scab or not.

Zinc oxide tuber treatment – 1 kg/tonne Zinc oxide (80%)
Fluazinam soil treatment – 3 l/ha Shirlan incorporated into soil prior to planting
Zinc soil treatment – 15 kg/ha zinc incorporated into soil as 36% mixture of zinc sulphate and zinc oxide

Assessments were made of emergence, vigour, yield and tuber numbers and disease on harvested tubers.

The soil pH was 6.2, the P_2O_5 status high and the zinc level moderate.

The trial was planted on 16 May 2008 and harvested on 7 October 2008

Results / Conclusions

Only the zinc oxide tuber treatment affected emergence and vigour. There were no consistent effects on tuber number or yield. There were differences in powdery scab on the progeny tubers. Fluazinam soil treatment consistently reduced incidence of powdery scab with an average reduction of 18%. Severity of powdery scab was also reduced, particularly in Estima. Overall the reduction of severity by fluazinam was 52% compared to the untreated. These reductions are comparable to those found in previous trials.

The zinc tuber and soil treatments had little effect on powdery scab.

The effect of changing the variety used from a susceptible one to a moderately susceptible one was to reduce severity of powdery scab by 75%. However, the incidence was not changed.

There were few differences between using seed that exhibited powdery scab lesions and seed that was symptomless.

Table 2 – Incidence and severity of powdery scab on progeny tubers

% incidence powdery scab				
		Estima	Marfona	Mean
Infected seed	Untreated	45	42	43.5
	Zinc oxide tuber treatment	46	41	43.5
	Fluazinam soil treatment	36	35	35.5
	Zinc soil treatment	38	44	41
Symptomless seed	Untreated	41	40	40.5
	Zinc oxide tuber treatment	36	41	38.5
	Fluazinam soil treatment	33	34	33.5
	Zinc soil treatment	46	39	42.5
% severity powdery scab				
		Estima	Marfona	Mean
Infected seed	Untreated	11	2.1	6.55
	Zinc oxide tuber treatment	10.5	1.9	6.2
	Fluazinam soil treatment	3.7	1.1	2.4
	Zinc soil treatment	5.5	2.6	4.05
Symptomless seed	Untreated	6.8	2.3	4.55
	Zinc oxide tuber treatment	7.1	2.5	4.8
	Fluazinam soil treatment	3.3	2.8	3.05
	Zinc soil treatment	18.4	1.8	10.1

Table 3 – Products evaluated

Treatment	Active ingredient	Product	Product dose
1	Fluazinam	Shirlan	3 l/ha (500 g/l)
2	Zinc oxide	Analar zinc oxide	1 kg/tonne (80%)
3	Zinc oxide and sulphate	Fertiliser	42 kg/ha (36%)

Determining the optimum nitrogen for a ware crop 2008

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Introduction

Both RB209 and the Scottish fertiliser recommendations are under review with revised recommendations to be launched in spring 2009. In order to both highlight the revisions of fertiliser recommendations and to provide further data to contribute to the review, a replicated field trial was established at PIP to examine optimum nitrogen requirements for a ware crop of Saxon (second early).

The soil analysis for the site was:

pH	6.2
P	44 mg/kg High
K	141 mg/kg Moderate
Mg	82 mg/kg Low
Zn	6.7 mg/kg Moderate

No slurry or manure had been applied

Previous cropping:	2004 Spring barley
	2005 Spring barley
	2006 Spring barley
	2007 Winter wheat
Potatoes last grown:	2003

Using current Scottish and RB209 fertiliser recommendations the recommended nitrogen treatments were 250 or 240-270 kg/ha respectively. 250 kg/ha was used as the standard application and 0, 0.5, 0.75 & 1.25 of this standard dose were compared to the standard. Phosphate and Potash applications were consistent at 100 and 200 kg/ha respectively.

The Saxon seed used was free from common or powdery scab, had traces of black dot and silver scurf. The level of black scurf (48% incidence, 2.7% average severity) was high and the seed was treated with Monceren. Rhizoctonia did not affect growth of the crop.

The trial was planted on 15 May 2008 and harvested on 7-8 October 2008

Results / Conclusions

Although the trial followed a cereal crop and soil N residues would have been low, the yield without nitrogen achieved almost 40 t/ha. A significant increase in yield occurred with the application of 125 kg/ha but no further significant increase in yield with further increases in nitrogen.

In the 45-65mm grading fraction, the yield of the nil nitrogen treatment was significantly higher than that of the 250 and 325 kg/ha nitrogen treatments. Conversely, in the 65-85mm (baker) fraction the weight of the nil nitrogen treatments was significantly less than all nitrogen treatments, which were not significantly different from each other.

The yield response curve for nitrogen was characteristically flat (Figure 1). At current prices of nitrogen fertiliser there was little advantage in terms of total yield of applying more than 150 kg/ha N. However, there was a trend for increasing tubers of baker size with increasing nitrogen. When the additional value of the baker fraction was considered the rate determined from current Scottish and RB 209 recommendations was close to the optimum.

2008 was a season characterised by high rainfall and availability of nitrogen was high.

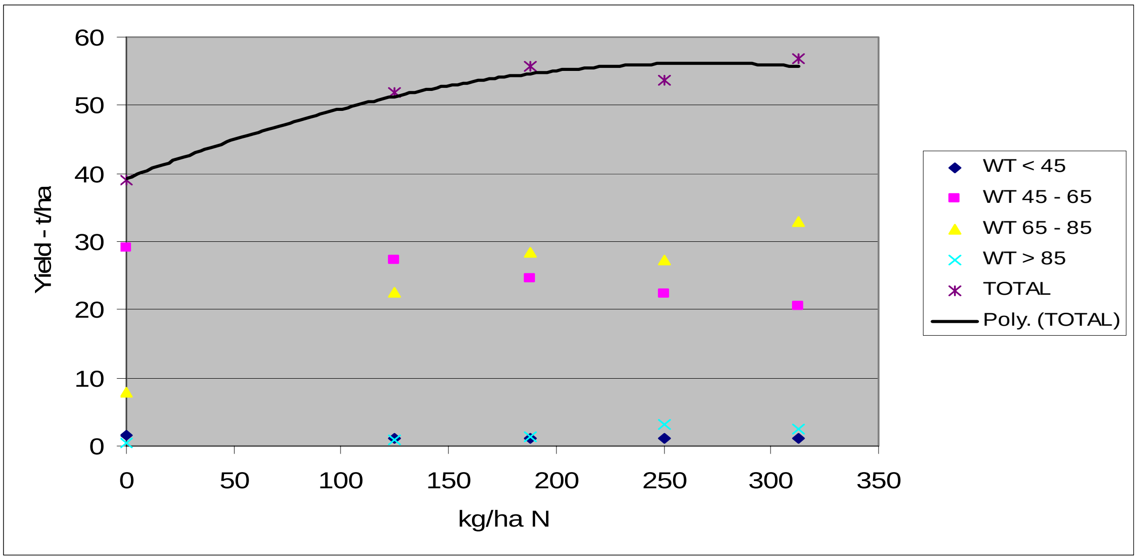

Figure 2. Total yield and yield of grading fractions

There were no significant differences in total tuber numbers between any treatment (Figure 2). However, there was a general increase in tuber numbers in the 65-85mm fraction and decrease in tuber numbers in the 45-65mm fraction with increasing nitrogen level.

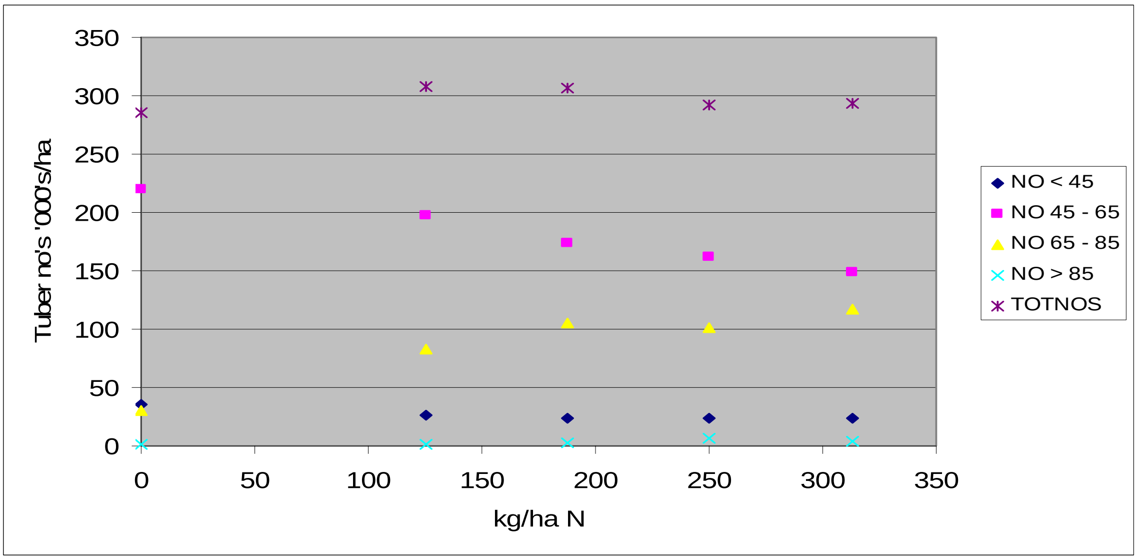

Figure 3. Total tuber numbers and tuber numbers in grading fractions

Evaluation of haulm destruction programmes 2008

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Introduction

With the potential withdrawal of sulphuric acid as a haulm destruction option, greater reliance will be placed on haulm cutting and other (slower) haulm desiccation treatments. A replicated trial was established at PIP to evaluate speed of haulm destruction and its effect on skin setting. The variety chosen was Nicola which has a thin skin and without careful fertiliser management can take a long time to set skins. The treatments were applied before the PIP event in order for the effect to be evident on the day of the event. The haulm was still mostly green at the time of the first treatments.

The treatments applied were:

Treatment no.	30 July 2008	11 August 2008
1	No haulm destruction	-
2	Haulm cutting	Reglone (2.5 l/ha)
3	Haulm cutting	Spotlight Plus (1.0 l/ha)
4	Reglone (1.5 l/ha)	Reglone (2.5 l/ha)
5	Reglone (1.5 l/ha)	Spotlight Plus (1.0 l/ha)

Haulm cutting was carried out by hand leaving 20-30cm stem

Assessments were made of the degree of skin set measured using the SAC scuffing barrel, the damage index, regrowth and bruising.

The trial was planted on 16 May 2008 and harvested on 7 October 2008

Results / Conclusions

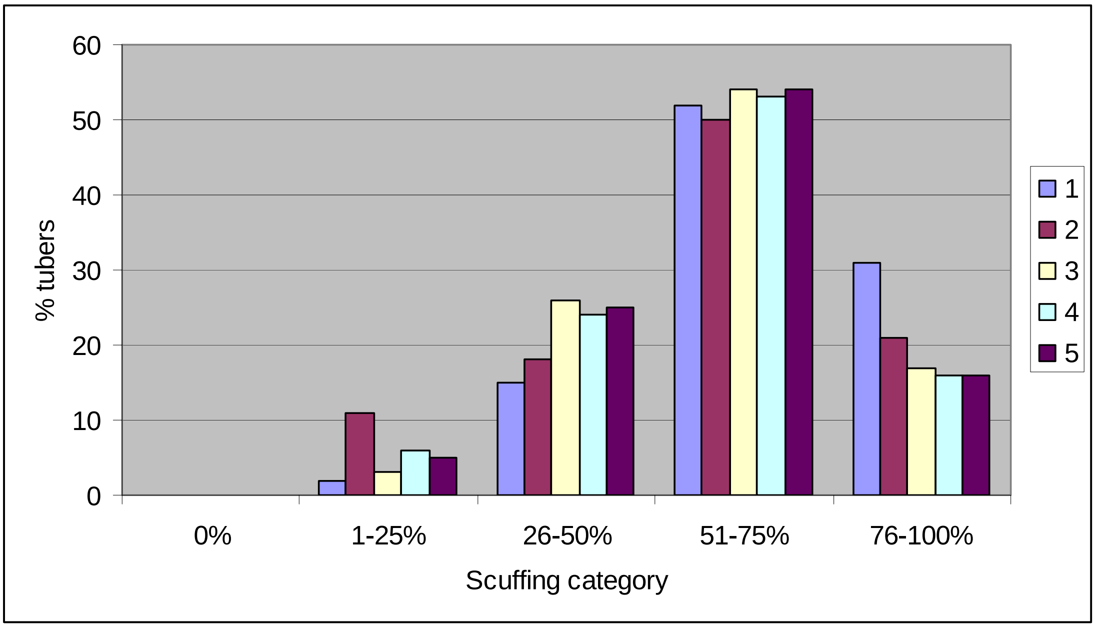

Figure 4. Scuffing assessment 5 August 2008

On the 5th August, 6 days after the first treatments were applied there were no significant differences between haulm cutting and Reglone (first treatments) in skin set or with the untreated control. This was confirmed in the damage index (Table 1).

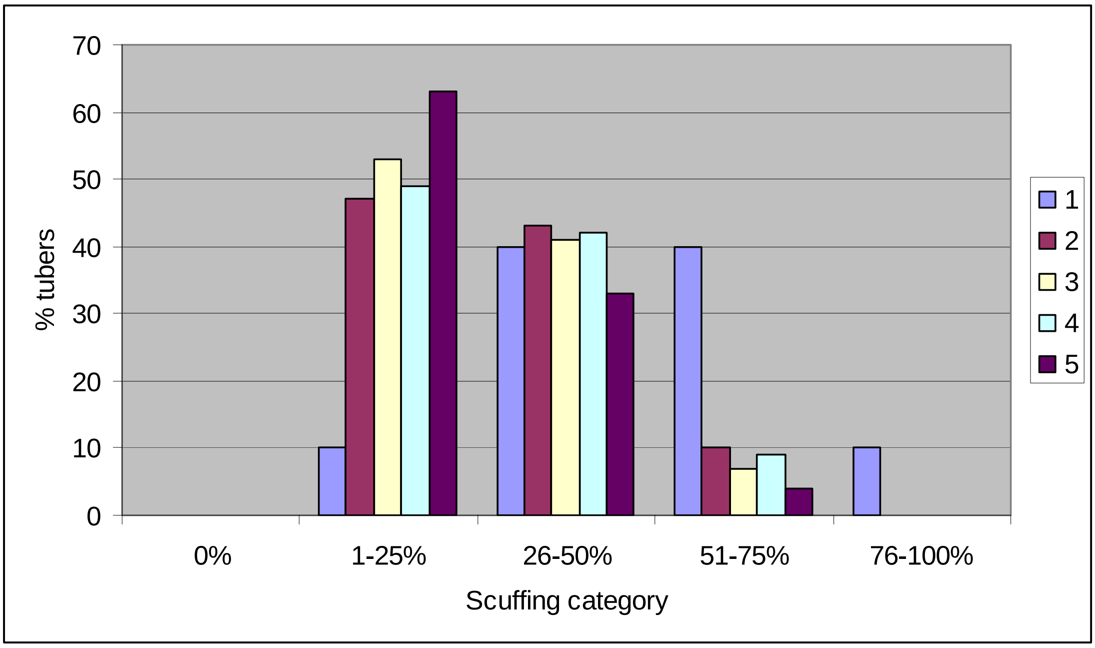

Figure 5. Scuffing assessment 28 August 2008

At the second assessment of skin setting, 29 & 17 days after the first and second treatments respectively, significant differences were apparent. Skin setting at this assessment was still far from complete. The percentage of tubers showing skin setting in the 51-75% and 76-100% surface area scuffing categories was significantly less for all treatments compared to the untreated control. Conversely, in the 1-25% surface area category there were significantly more tubers with each treatment than the untreated control. Treatment 5, Reglone followed by Spotlight had significantly more tubers in this category than other treatments. Treatment 5 had a significantly lower damage index than the other haulm destruction treatments, which in turn were significantly less than the untreated (Table 1)

Table 4. Effect of haulm destruction treatments on damage index

Assessments					
Treat. No.	Treatment	Tuber damage index 5 August	Tuber damage index 28 August	Regrowth 6 October	Bruising post harvest
1	Untreated	3.1 a	2.5 a	100 a*	3 a
2	HC fb Reglone	2.9 a	1.6 b	1.1 b	4 a
3	HC fb Spotlight	2.8 a	1.6 bc	2 b	2 a
4	Reglone fb Reglone	2.8 a	1.6 bc	0.4 b	4 a
5	Reglone fb Spotlight	2.8 a	1.4 c	0 b	3 a
LSD (5%)		0.43	0.15	1.56	3.5
HC = Haulm cutting					
* At harvest stems in the untreated were still green					

On the 6 October just prior to harvest, stems of the untreated were still green. Regrowth in the other treatments was limited and there was no significant difference between them. Bruising at harvest was limited with no difference between any treatment (Table 1).

Overall, there were few differences between haulm cutting followed by application of a haulm desiccant and a sequence of haulm desiccants.

Table 5 – Products evaluated

Treatment	Active ingredient	Product	Product concentration
1	Diquat	Reglone	200 g/l
2	Carfentrazone-ethyl	Spotlight	60 g/l

Determining the optimum phosphate for a ware crop 2008

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Introduction

Both RB209 and the Scottish fertiliser recommendations are under review with revised recommendations to be launched in spring 2009. In order to both highlight the revisions of fertiliser recommendations and to provide further data to contribute to the review, a replicated field trial was established at PIP to examine optimum phosphate requirements for a ware crop of Saxon (second early). Previous phosphate trials at PIP had indicated that for soils with upper moderate or high phosphate levels, current fertiliser recommendations were recommending over what was required.

The soil analysis for the site was:

pH	6.2
P	44 mg/kg High
K	141 mg/kg Moderate
Mg	82 mg/kg Low
Zn	6.7 mg/kg Moderate

No slurry or manure had been applied

Previous cropping:	2004 Spring barley
	2005 Spring barley
	2006 Spring barley
	2007 Winter wheat
Potatoes last grown:	2003

Using current RB209 fertiliser recommendations the recommended phosphate treatment for index 3 is 130 kg/ha, and index 4 is 50 kg/ha. 100 kg/ha was used as the standard application and 0, 0.5, 0.75 & 1.25 of this standard dose were compared to the standard. Nitrogen and Potash applications were consistent at 250 and 200 kg/ha respectively.

The Saxon seed used was free from common or powdery scab, had traces of black dot and silver scurf. The level of black scurf (48% incidence, 2.7% average severity) was high and the seed was treated with Monceren.

The trial was planted on 15 May 2008 and harvested on 7-8 October 2008

Results / Conclusions

The trial was carried out on a site where soil phosphate reserves were high (Scottish category, index 3-4 for England). Previous experience from trials on the same site had suggested responses would be small. However, responses in total yield at 75, 100 and 125 kg/ha were significantly greater than at 0 or 50 kg/ha. The increases came in the weight of the 65-85mm (baker) fraction. The optimum economic phosphate level was considered to be 75 kg/ha.

It has been a belief in Scotland that phosphate is important for tuber set, especially in colder soils. However, there were no significant differences in total tuber numbers between treatments. Only in the 65-85mm fraction were significant increases in tuber numbers evident in the 75, 100 and 125 kg/ha treatments.

2008 was a season characterised by high rainfall.

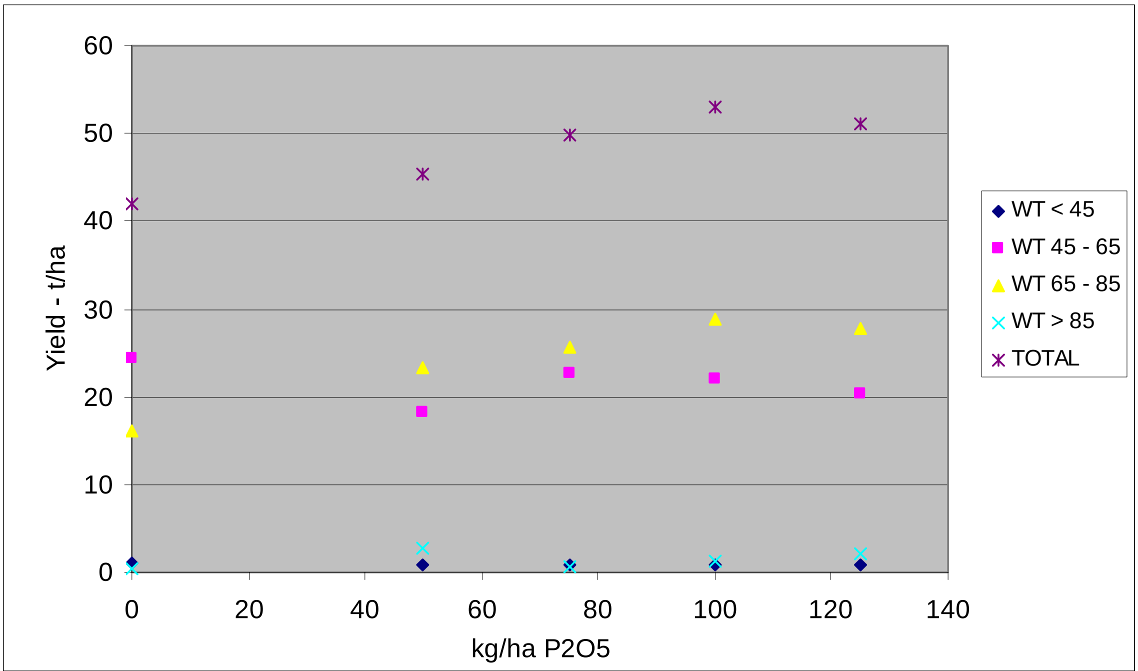

Figure 6. Total yield and yield of grading fractions

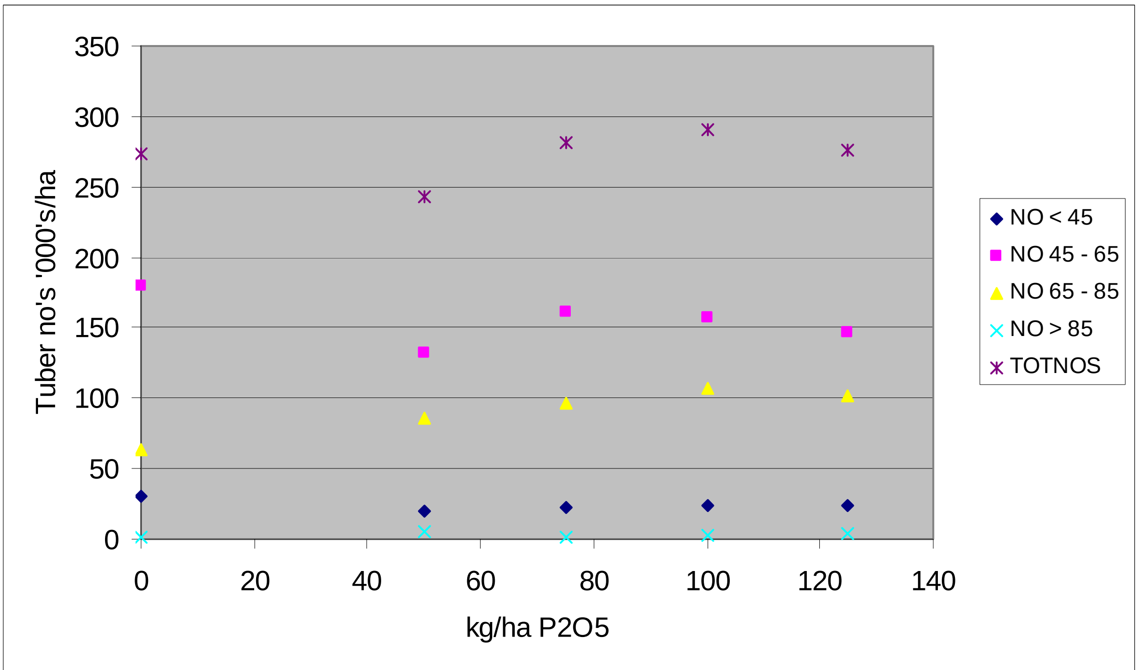

Figure 7. Total tuber numbers and tuber numbers in grading fractions

The carbon footprint of the potato crop

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An initial study by climate change modellers at Aberdeen University and potato scientists at SAC has developed the first carbon footprint for a potato crop.

Concerns about greenhouse gas emissions and their global warming effect have recently inspired the quantification of the Carbon footprint of many anthropological activities. This is particularly true in agriculture due to the production of bioenergy crops as alternative sources of fossil fuels. Quantification of Carbon costs looks at inputs and practices against benefits of displacing Carbon released by fossil fuel burning. In essence this consists of quantifying the Carbon footprint of production, transport and storage, and then offsetting this against the energy generated from the bioenergy crop.

However, determining the Carbon footprint is useful for food crops as well as for energy crops since any reduction to it can be regarded as Carbon mitigation. Since potato production requires quite heavy machinery use, and fairly high fertiliser rates it certainly justifies the effort. To our knowledge this has not yet been made, and we make a first analysis here. This analysis considers only the "farm gate" (planting - harvest) Carbon footprint. Consideration of what happens beyond the farm gate requires much more exhaustive analysis which more importantly also depends on end use.

Climate change terminology

Carbon footprint - measure of the impact an activity has on the environment in terms of the amount of green house gases produced
Carbon mitigation - reduction of carbon emissions through changing practices
Global warming potential (GWP) – the warming effect a greenhouse gas has on the environment in relation to CO2 (based on its heat-absorbing ability and time of persistence in the atmosphere).
IPCC – Intergovernmental Panel on Climate Change

In this exercise we have first selected a management scheme which was representative of what might be employed to a "typical" ware crop of Maris Piper in the U.K. Our analysis considered agronomic practices, production costs of fertiliser and pesticides and harvest. In our "typical" crop we have assumed the following have occurred.

- Soil preparation; ploughing, deep ridging, stone separation, bed tilling (Cost of operations)
- Fungicide seed treatment (Product manufacture)
- Fertiliser application; N – 200 kg/ha, P – 150 kg/ha, K – 150 kg/ha (Production, application and emissions costs)
- Planting (Operation costs)
- Irrigation

- Blight spray (8 times) application (Product manufacture and application)
- Slug pellet application (Product manufacture and application)
- Aphicide application (Product manufacture and application)
- Haulm destruction (Product manufacture and application)
- Harvest and Removal

Average figures for numerous farming operations as well as for fertiliser, herbicide, insecticide, and fungicide production are available in the scientific literature. This allowed us to calculate an approximate per hectare per annum Carbon Footprint for potato production. An additional factor from farming is the direct Nitrous Oxide emissions known to be associated with N-fertiliser application. The IPCC has estimated the rate of emissions to be approximately 1.25 kg Nitrous Oxide (N_2O) for each 100 kg N-fertiliser applied. In addition N_2O is known to be a particularly harmful greenhouse gas with a GWP of 310 (it is 310 times more harmful than CO_2). After conversion to carbon equivalents (CE) this emissions figure was added to the C figure and we obtained the total Carbon footprint of potato of ~924 kg CE/ha/year.

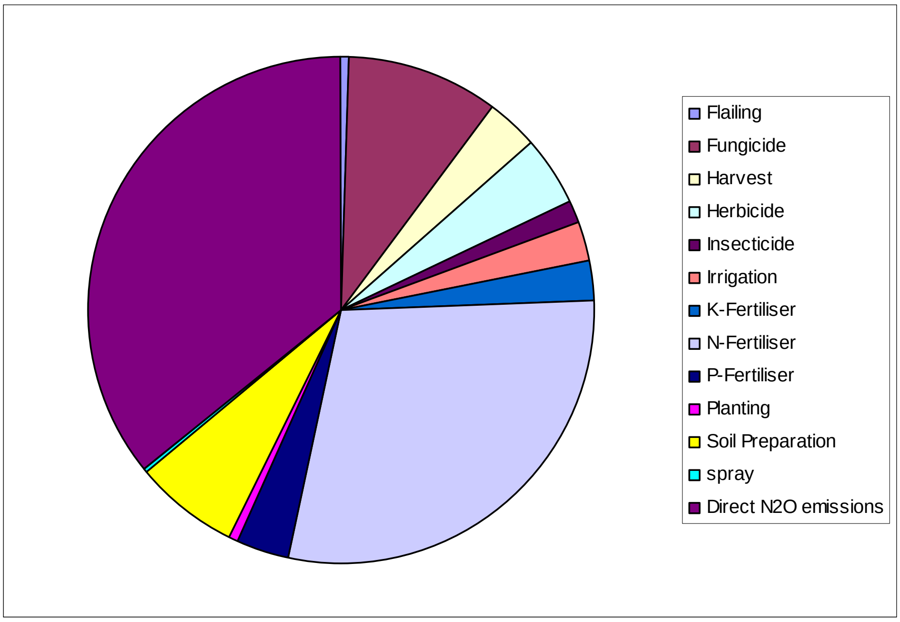

Figure 8. Percentage contribution of individual operations to Carbon footprint of a potato crop

This compares with figures for winter wheat and oilseed rape, estimated to be 582 and 549 kg CE/ha/yr respectively. All these crops typically require similar amounts of N-fertiliser but potato generally has more and heavier mechanical operations associated with its management which leads to the larger carbon footprint. If we were to consider a "carbon footprint per tonne food produced" potato would score much better since the yield for potatoes is generally an order of magnitude higher than for wheat or OSR (potato 52.7 t/ha, WW 8.48 t/ha, OSR 3.65 t/ha). However, since potatoes only have 20% dry matter compared, with 85% wheat and 91% oilseed rape it could be argued that you should be looking at the footprint per tonne of dry matter. After all 80% of a potatoes production costs are all going into water!

Crop	**Kg CE/ha/year**	**Kg CE/tonne/year**	**Kg CE/t dry matter/ year**
Potato	909	17.2	86.0
Wheat	582	68.6	78.9
Oilseed rape	549	150.4	163.9

However, if we examine the carbon footprint, emissions associated with N-fertiliser account for 64% of the total figure (this compares with 88% for winter wheat and 72% for OSR). This indicates that, for example, reducing N-fertiliser application rates by 50 kg/ha/year would reduce the carbon footprint by 16%.

Currently potatoes are planted on around 30,000 hectares in Scotland representing around 1.5-2.0% of agricultural land. So the contribution to the national Carbon footprint of 15.69 Mt CE/yr is relatively small (0.18%). On the other side, if we were to consider (secondary) storage and transport C costs in addition to the primary (farming) and tertiary (production) costs considered here the figure would be relatively higher since potato is a bulky crop which is often cold stored for many months. With seed production there are also costs associated with shipping boxes of seed to export markets. We have also not considered changes in soil C and N pools which are known to vary as a function of crop type and management practice. Since potato cultivation involves lifting and moving large amounts of soil it is likely in general to increase soil respiration rates and thus emissions.

Based on our figures, the farm gate arable activities (primary and tertiary) account for slightly over 8% of the Carbon footprint for Scotland, of which around 75% is related to N fertiliser use. This is in good agreement with the National GHG Inventory. Thus N-fertiliser use contributes around 6.5% of the nation's Carbon footprint. Avenues to reduce this figure should surely be explored. A simple model such as the one developed here can be used to highlight areas of carbon savings. The next stages would be to combine this with a soil Carbon and Nitrogen turnover model such as DNDC or ECOSSE and then validate the outputs against experimental data. More thorough efforts should also be made to see how carbon savings can be made in crops other than our "typical" one.

References

Land use census for Scotland:
http://www.scotland.gov.uk/Publications/2007/10/agriccensus2007/Q/EditMode/on/ForceUpdate/on/Page/2

Scotland's Carbon Footprint:
http://www.scotlandsfootprint.org/pdfs/LowFootprintScotland.pdf

Intergovernmental Panel on Climate Change:
http://www.ipcc.ch/

DNDC Soil C&N turnover model
http://www.dndc.sr.unh.edu/

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3 - CSC Crop Protection

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Herbicide Trial

Introduction

Demonstration plots looking at different herbicide mixes applied pre and post weed emergence.

Table 6 – Herbicide mixes

Treatment	Active ingredient	Product	Product dose	Application Time
1	Untreated			
2	Prosulfocarb Linuron	Defy Linuron	4 l/ha 1.3 l/ha	Post-Planting Post-Planting
3	Prosulfocarb Metribuzin	Defy Sencorex	4 l/ha 0.5 kg/ha	Post-Planting Post-Planting
4	Pendimethalin Metribuzin	Stomp Sencorex	3.3 l/ha 0.5 kg/ha	Post-Planting Post-Planting
5	Clomazone Metribuzin Linuron	Gamit Sencorex Linuron	0.25 l/ha 0.5 kg/ha 1.3 l/ha	Post-Planting Post-Planting Post-Planting
6	Prosulfocarb Metribuzin Glufosinate-ammonium	Defy Sencorex Basta	4 l/ha 0.35 kg/ha 2 l/ha	Pre-Em Pre-Em Pre-Em
7	Prosulfocarb Metribuzin Carefentrazone-ethyl	Defy Sencorex Shark	4 l/ha 0.35 kg/ha 0.333 l/ha	Pre-Em Pre-Em Pre-Em
8	Prosulfocarb Metribuzin Diquat	Defy Sencorex Retro	4 l/ha 0.35 kg/ha 2 l/ha	Pre-Em Pre-Em Pre-Em
9	Prosulfocarb Metribuzin Diquat Carefentrazone-ethyl	Defy Sencorex Retro Shark	4 l/ha 0.35 kg/ha 2 l/ha 0.2 l/ha	Pre-Em Pre-Em Pre-Em Pre-Em
10	Prosulfocarb Linuron Diquat	Defy Linuron Retro	4 l/ha 1 l/ha 2 l/ha	Pre-Em Pre-Em Pre-Em
11	Pendimethalin Metribuzin Diquat	Stomp Sencorex Retro	3.3 l/ha 0.35 kg/ha 2 l/ha	Pre-Em Pre-Em Pre-Em
12	Clomazone Metribuzin Carefentrazone-ethyl	Gamit Sencorex Shark	0.2 l/ha 0.5 kg/ha 0.333 l/ha	Pre-Em Pre-Em Pre-Em

Results / Conclusions

At the rate 1.3 l/ha the Linuron treatments performed poorly in the control of AMG (annual meadow grass), with the Stomp (pendimethalin) and Defy (prosulfocarb) giving the best post planting treatment control (treatments 3 and 4).
With regards to contact herbicides, Retro (diquat) gave moderate control of AMG and Shark (carefentrazone-ethyl) and Basta (glufosinate-ammonium) gave some control.
Broad leaf weed control post planting was variable, with Defy showing the best result, though it would have needed a follow up treatment. We did carry out a follow up

treatment of Titus (rimsulfuron) across the front of the post planting plots which gave very good control in such a poor season for weed control.
Pre-em broad leaved weed control, the contact herbicides Retro + Shark (treatment 9) gave the best control, with Retro on its own giving the second best control.

Out of the residual products treatment 12 gave the best control with treatment 8 following that.

In summary it was a poor season for weed control, but where we added the Titus across the front of the plots the weed control was improved greatly.

Foliar Nutrition Trial – Marfona
Foliar Nutrition Trial – Maris Piper

Introduction

Aim of trial was to demonstrate performances of various crop stimulants within a non prolific variety 'Marfona' and on a prolific variety 'Maris Piper'. Below are bar charts showing total and marketable yields and the treatments' effect on skin finish scored out of 10.

Results / Conclusions
Treatments

All the treatments had an application of 230 kg/ha Phosphate, 275 kg/ha of Potash and 225 kg/ha of Ammonium Nitrate, the 'Maris Piper' had a reduced rate of Ammonium Nitrate due to varietal differences in requirement (205 kg/ha). Treatments 7 and 8 had a 25% reduction in base fertiliser to see the effects of replacing the base NPK with some foliar NPK.

Table 7 - Treatments

Treatment Number	Product	Product Dose	Application Time
1 (Untreated)	Phosphate Potash Ammonium Nitrate	230 kg/ha 275 kg/ha 225 kg/ha	Bed Bed Bed
2	Nutri-phite Take-off Nutri-phite Take-off	2 l/ha 0.25 l/ha 1 l/ha 0.25 l/ha	
3	Nutri-phite Take-off Nutri-phite Take-off Nutri-phite Take-off	2 l/ha 0.25 l/ha 1 l/ha 0.25 l/ha 0.5 l/ha 0.25 l/ha	
4	Fastmix K Microbooster	3 kg/ha	
5	Intrafol complete	10 l/ha	
6	Micromix granules Set	100 kg/ha 5 l/ha	Bed
7	Establish 5/16/12 Huma Balance Soil Restore	3.75 l/ha 3.75 l/ha 0.148 l/ha	Bed Bed Bed
8	Establish 5/16/12 Huma Balance Soil Restore Maintain 8/16/8	3.75 l/ha 3.75 l/ha 0.148 l/ha 3 l/ha	Bed Bed Bed
9	Bittersalz Sunburst Manganese Sulphate TTL Plus	3 kg/ha 20 l/ha 2.5 kg/ha 2 l/ha	

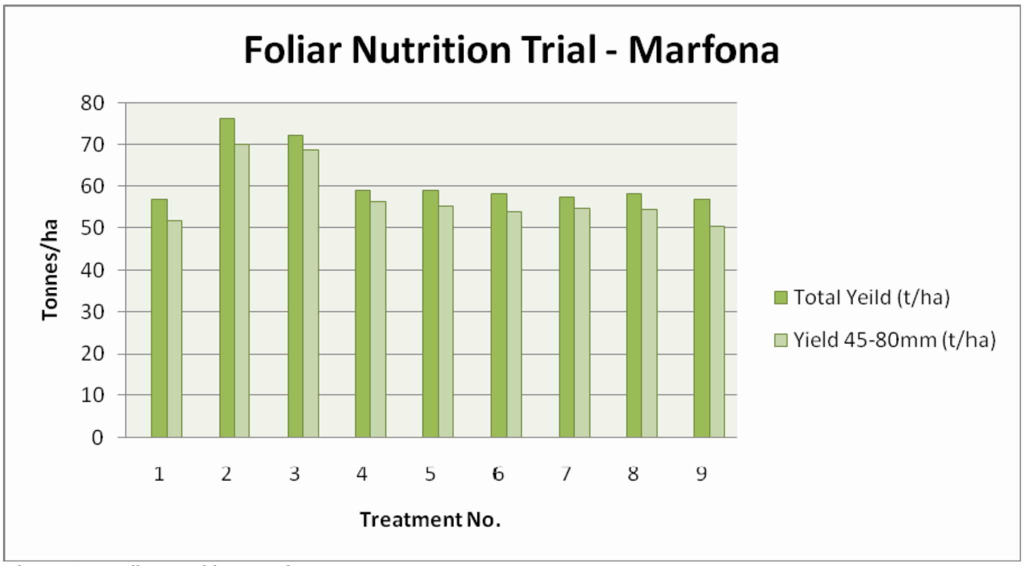

Figure 9 – Foliar nutrition Marfona

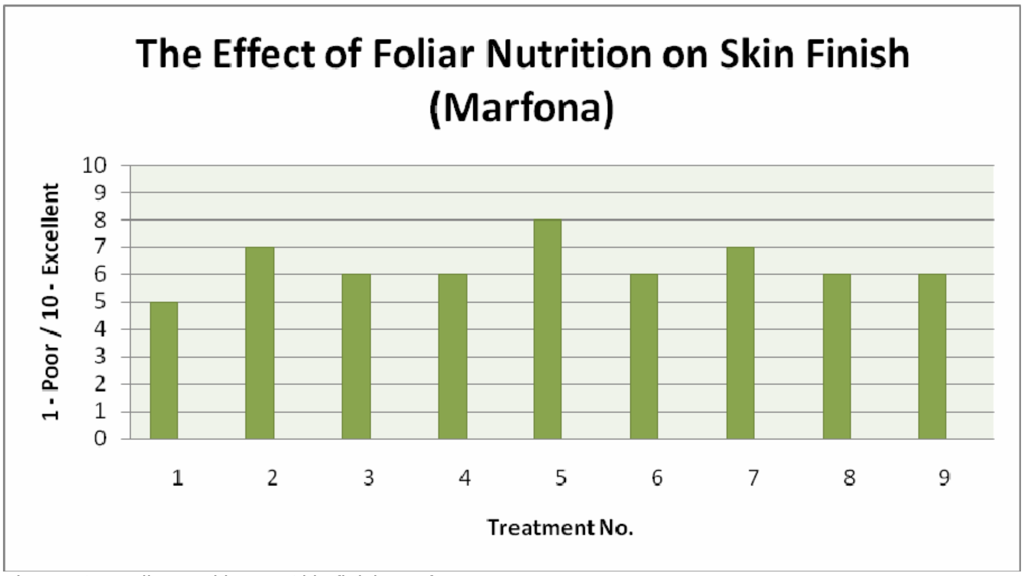

Figure 10 – Foliar nutrition on Skin finish Marfona

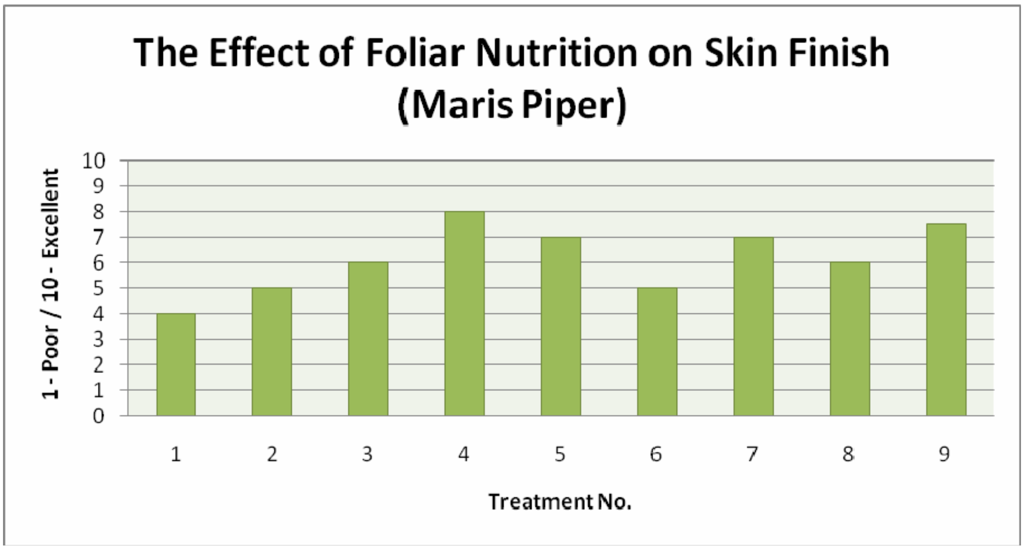

Figure 11 – Foliar nutrition on Skin Finish Maris piper

Treatment 1 was the control in the trial. The highest yielding treatment was 2 which was given the same levels of NPK as the control but had Nutri-phite and Take-Off applied twice, this increased the marketable yield by 27% and the skin finish score by 2. It also improved the number of tubers in the 65-80mm range by 26% and a reduction in smalls of 5% (<45mm).

The untreated trial in the 'Maris Piper' showed the poorest skin finish score out of all the trials including the common scab trial, with treatment 4 giving the best result which had 3 kg/ha of Fastmix K Microbooster on top of base fertiliser and gave an improvement in skin finish of 4.

Common Scab Reduction Demo

Introduction

This trial continues our work looking at the effects of sulphur nutrition on Common Scab control. All treatments had Phosphate and Potash applied at 230kg/ha and 275 kg/ha respectively.

Results / Conclusions

Table 8 – Treatments

Treatment Number	Product	Product Dose	Application Time
1	Ammonium Nitrate	180 kg/ha	Bed
2	Ammonium Nitrate	100 kg/ha	Bed
	Ammonium Sulphate	822 l/ha	Bed
3	Ammonium Nitrate	60 kg/ha	Bed
	Ammonium Sulphate	1233 l/ha	Bed
4	Ammonium Nitrate	180 kg/ha	Bed
	Sulphur Pellets	200 kg/ha	Bed
5	Ammonium Nitrate	100 kg/ha	Bed
	Ammonium Sulphate	822 l/ha	Bed
	Sulphur Pellets	200 kg/ha	Bed
6	Ammonium Nitrate	60 kg/ha	Bed
	Ammonium Sulphate	1233 l/ha	Bed
	Sulphur Pellets	50 kg/ha	Bed
7	Ammonium Nitrate	60 kg/ha	Bed
	Ammonium Sulphate	1233 l/ha	Bed
	Sulphur Pellets	50 kg/ha	Bed
	Zinc Pellets	50 kg/ha	Bed
8	Ammonium Nitrate	60 kg/ha	Bed
	Ammonium Sulphate	1233 l/ha	Bed
	Sulphur pellets	50 kg/ha	Bed
	Thiovit	20 kg/ha	TI
9	Ammonium Nitrate	60 kg/ha	Bed
	Ammonium Sulphate	1233 l/ha	Bed
	TTL Plus	5 l/ha	Bed
	Thiovit	20 kg/ha	TI
	Magik Manganese	5 l/ha	TI
	Magik Manganese	5 l/ha	TB

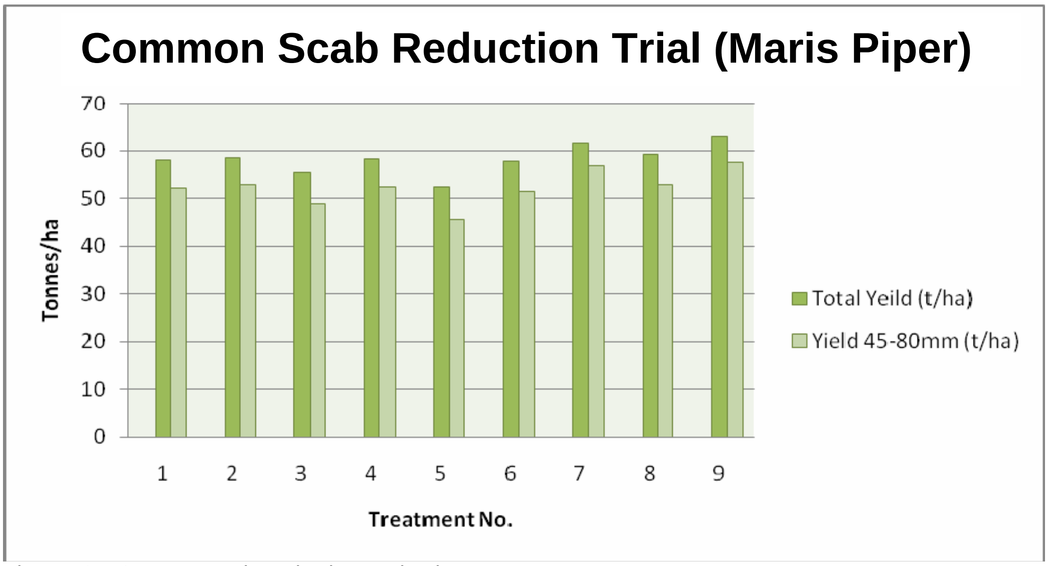

Figure 12 – Common scab Reduction Maris Piper

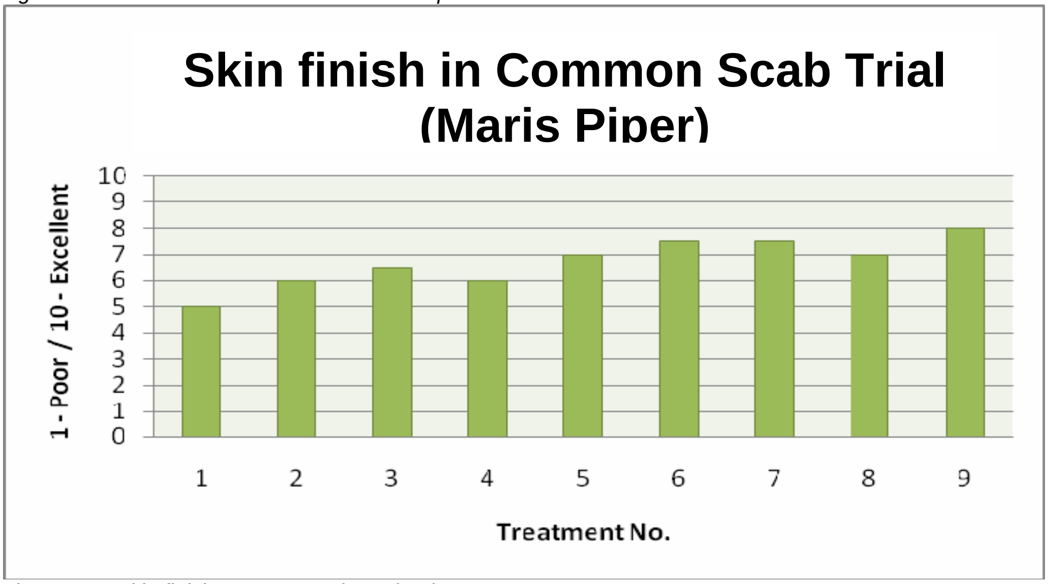

Figure 13 – Skin finish common scab Maris Piper

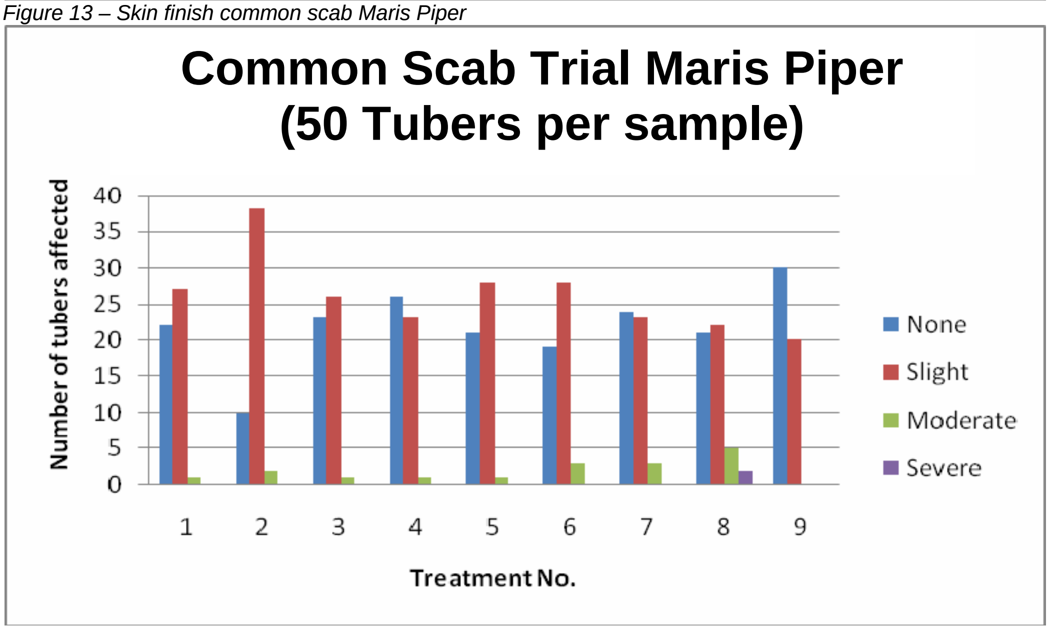

Figure 14 – Common scab Mairs Piper

The treatment that gives the biggest reduction in common scab is treatment 9 which was phosphate 230kg/ha, potash 275 kg/ha, ammonium nitrate 60 kg/ha, ammonium sulphate 1233 l/ha, TTL Plus 5 l/ha, Thiovit 20 kg/ha, two applications of Magik Manganese 5 l/ha (one at TI and the other at TB). This showed a 26% increase in tubers with no common scab and a reduction in slight by 25% and a complete reduction in moderate. An increase in ammonium sulphate from 822 l/ha to 1233 l/ha (treatment 2 and 3 respectivly) also a reduction in ammonium nitrate by 40 kg/ha increased the number of tubers without common scab by 56% and reduced those with slight common scab by 31%.

4 - SASA

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PMTV Varietal Susceptibility

Introduction

Potato mop-top virus (PMTV) causes spraing, necrotic arcs or flecks in the flesh of tubers. Foliar symptoms are generally considered to develop only on plants derived from infected tubers and not on plants infected from soil inoculum. The expression of symptoms can vary widely among varieties, ranging from severe to very mild effects.

Most evidence on the relative susceptibility of potato varieties to PMTV relates to symptom expression on plants and tubers. If growers are to make informed choices with respect to the risk of growing varieties susceptible to PMTV, it is essential to establish the relative susceptibility of the most popular varieties to infection by PMTV *per se* and not just to symptom development.

The aim of the project was to compare the relative susceptibility of ten commonly grown potato varieties to PMTV transmission and symptom expression. In 2007, this was done by planting PMTV-free tubers in a field soil naturally infested with PMTV. The following year, samples of the 1st year daughter tubers were planted in soil that was free from PMTV infestation in order to assess the degree of symptom development on plants produced by infected seed tubers and the amount of transmission of PMTV from seed to daughter tuber occurring within the plant. A replicated experiment was planted at SASA's Gogarbank Farm as part of a Potato Council-funded project and unreplicated plots were planted at PiP.

Results / Conclusions

Late application of a herbicide to control fumitory at PiP site distorted the plants and made identification of haulm symptoms of PMTV impossible. However, at the SASA site, more plants of vars Desiree and Slaney were affected by PMTV symptoms than those of the other varieties. Around 40% of symptom development on affected plants of var. Desiree occurred in early July towards the end of flowering. On most varieties, the symptoms were relatively mild, being distortion or discoloration of leaflets on one stem, accompanied by some reduction in length of the affected stem.

Classic symptoms of yellow chevrons were rare, occurring only on a plant of var. Estima and one of var. Hermes.

The incidence of PMTV in tubers was greatest for vars Desiree and Slaney and least for vars Hermes, Nicola and Rooster (Table 1). The incidence of spraing was generally low, with none being seen in tubers of vars Estima, Winston, Nicola, Hermes and Maris Piper. The highest incidence of spraing occurred in tubers of var. Saturna but the severity in most tubers was slight.

Overall, the incidence of PMTV declined in one year by c. 65%, confirming the nature of this virus to eliminate itself during vegetative propagation. It is worth noting that the proportion of PMTV-infected tubers which develop spraing can be relatively low and there was evidence to suggest that the proportion was lower when infected daughter tubers were derived from infected seed compared with those produced on plants infected from soil inoculum. This means that the risk of the virus having an economic effect on the crop is greatest in the first year of infection and decreases with each cycle of seed multiplication. The susceptibility of varieties to PMTV, haulm symptoms and spraing was found to differ for each of these components of the disease.

Table 8 – Mean incidence of potato mop-top virus (PMTV), spraing and powdery scab in 2008 on daughter plants and tubers of ten varieties derived from seed tubers produced in PMTV-infested soil the previous year (Midlothian site).

Variety	%* seed tubers infected by PMTV	% * daughter plants affected by PMTV	% * daughter tubers infected by PMTV	% tubers affected by spraing
Maris Piper	62.6	0	22.4	0
Desiree	73.0	26.4	32.4	0.3
Hermes	52.3	8.7	11.2	0
Estima	67.2	6.5	26.7	0
Saturna	64.9	12.6	24.3	12.5
Cara	59.9	6.2	21.3	2.2
Slaney	65.9	20.9	32.1	0.7
Winston	57.2	5.9	22.9	0
Nicola	62.5	4.7	17.3	0
Rooster	67.5	0	17.2	0.5
LSD(P = 0.05)	9.46	10.91	7.54	-

*% presented as angular transformation