POTATO PRODUCTION in the UK

JOHN SARUP

POTATOES NZ Biennial Conference

Pukekohe Indian Association Centre

26th July 2017

SPUD Agronomy & Consultancy Ltd

Topics

- SPUD Agronomy
- The role of the Agronomist – making a difference
- Brexit – challenges facing the UK Potato Industry
- UK potato production - the trends, the facts and the problems.
- PCN
- The importance of technology – Precision farming for Potatoes – SPot Farm
- Soils & Cultivations
- Nutrition/Biostims/Foliar Nutrition
- Seed
- Pesticides
- Storage

Who is SPUD Agronomy?

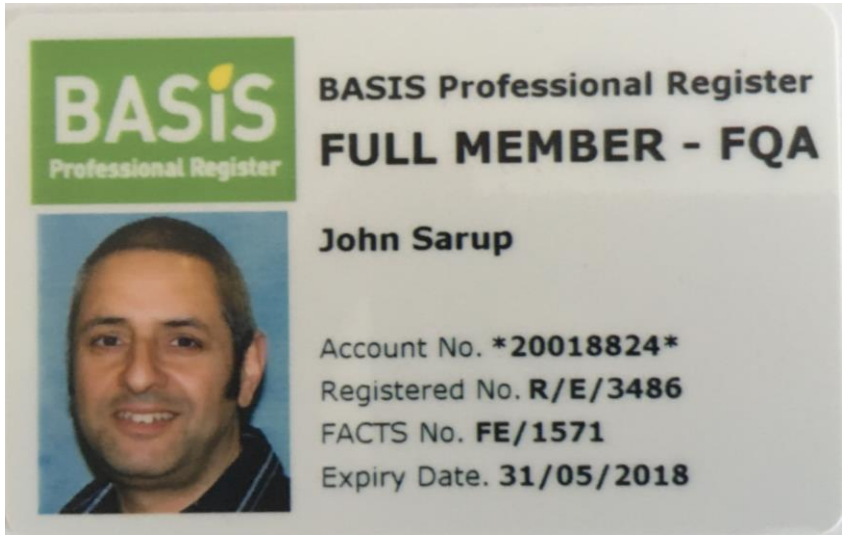
- John Sarup and Rob Blades
- Yorkshire, Lancashire, Cheshire and the Borders
- 11000 Acres (4400 Ha)
- Processing, Table, Bag Trade (chip shops) and Seed.
- Practical Agronomy advice based on knowledge and experience
- KE (knowledge exchange) & Training

How do we make a difference?

- All we sell is advice
- Independent
- Specialist
- Lots of practical experience
- Analyse research and put it into practical and cost effective ways in which growers can benefit
- Training
- KE

BASIS FACTS and CPD

Need to be a member of the BASIS Professional Register and Fertiliser Advisors certification and Training Scheme in order to advise on the use of pesticides and fertilisers

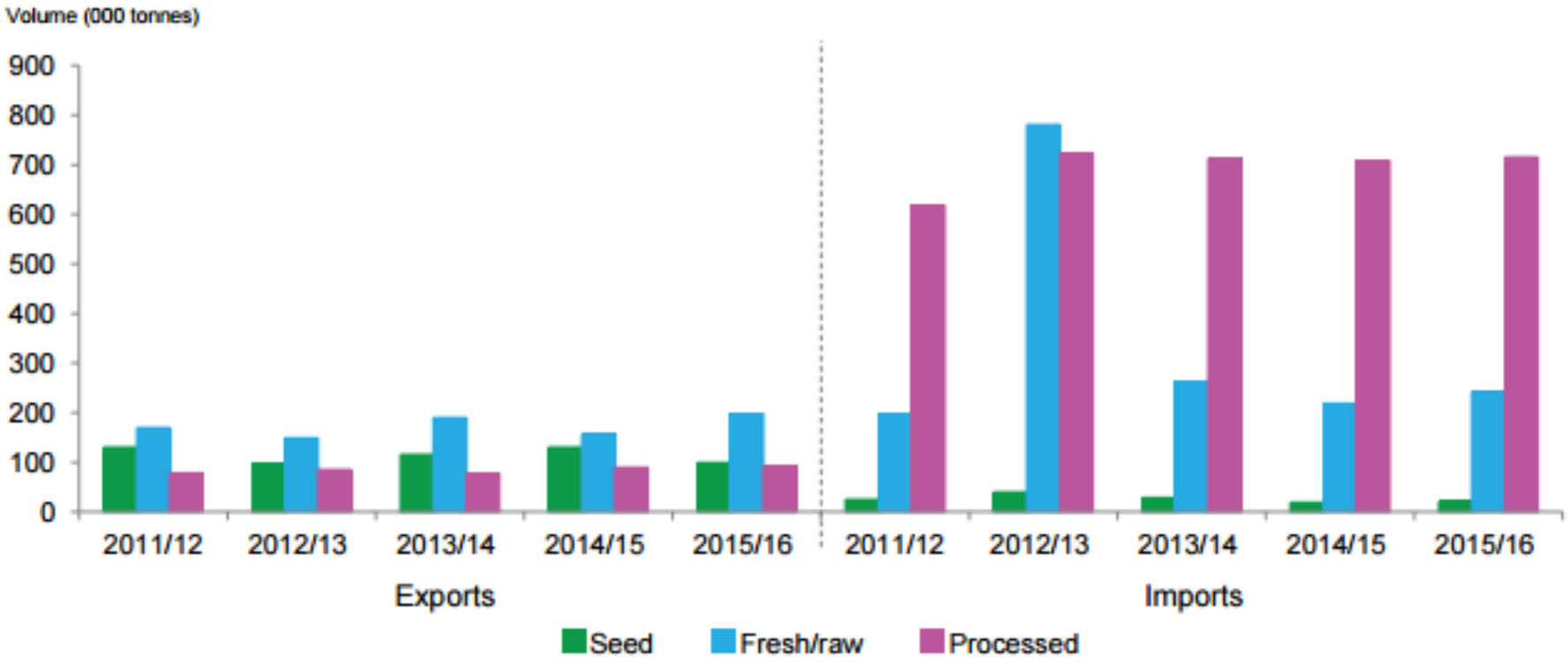


BREXIT – an opportunity?

Figure 17: UK exports and imports of potatoes by sector

Source: HMRC (October 2016)

Seasons from 1 July of year shown to 30 June of following year



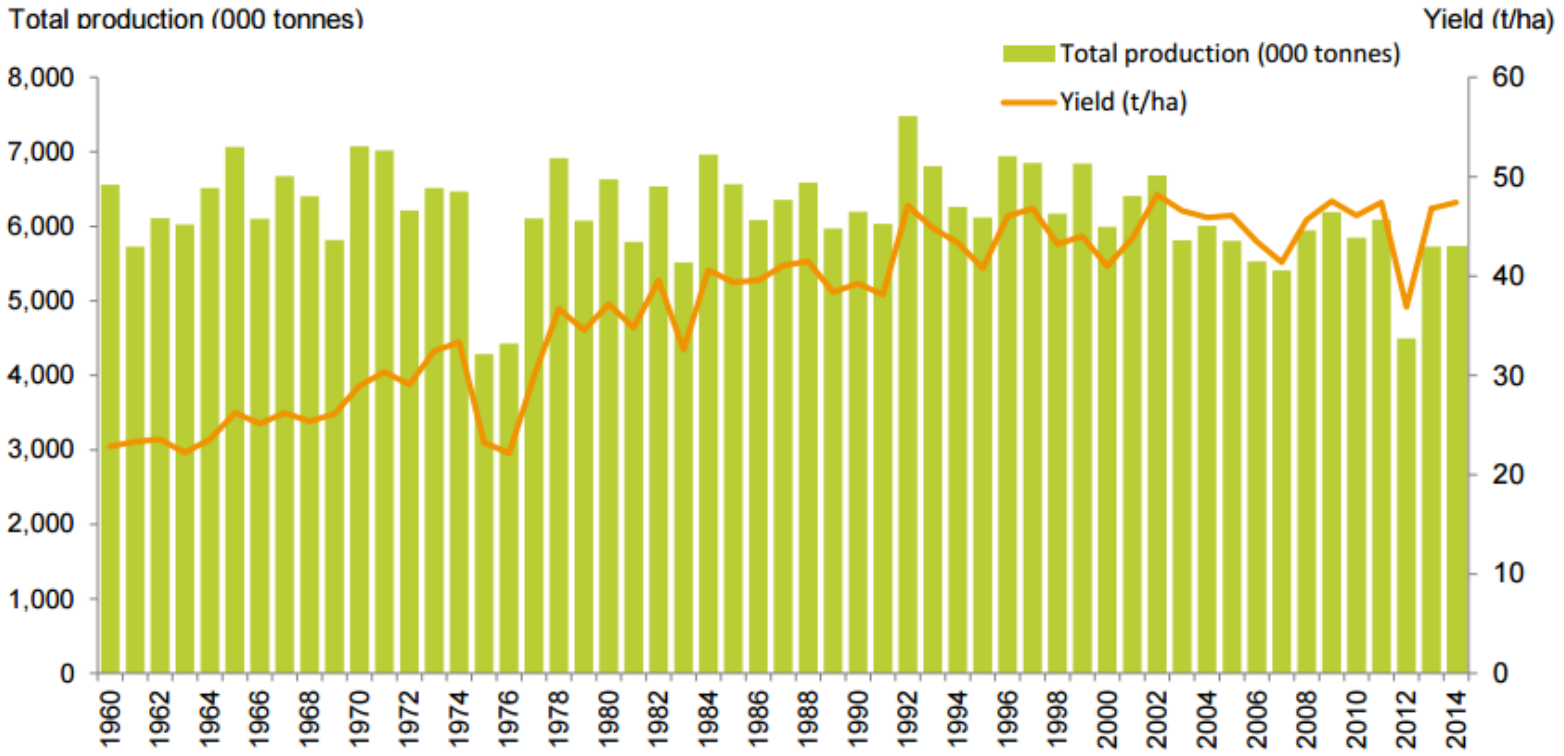
Other challenges facing UK Potato Production

- Succession
- Climate Change
- GM
- Loss of pesticide actives
- Land availability

Production

Figure 1: Yield per ha and total production 1960-2014

Source: AHDB Potatoes Grower Panel (Crop Data Forms)

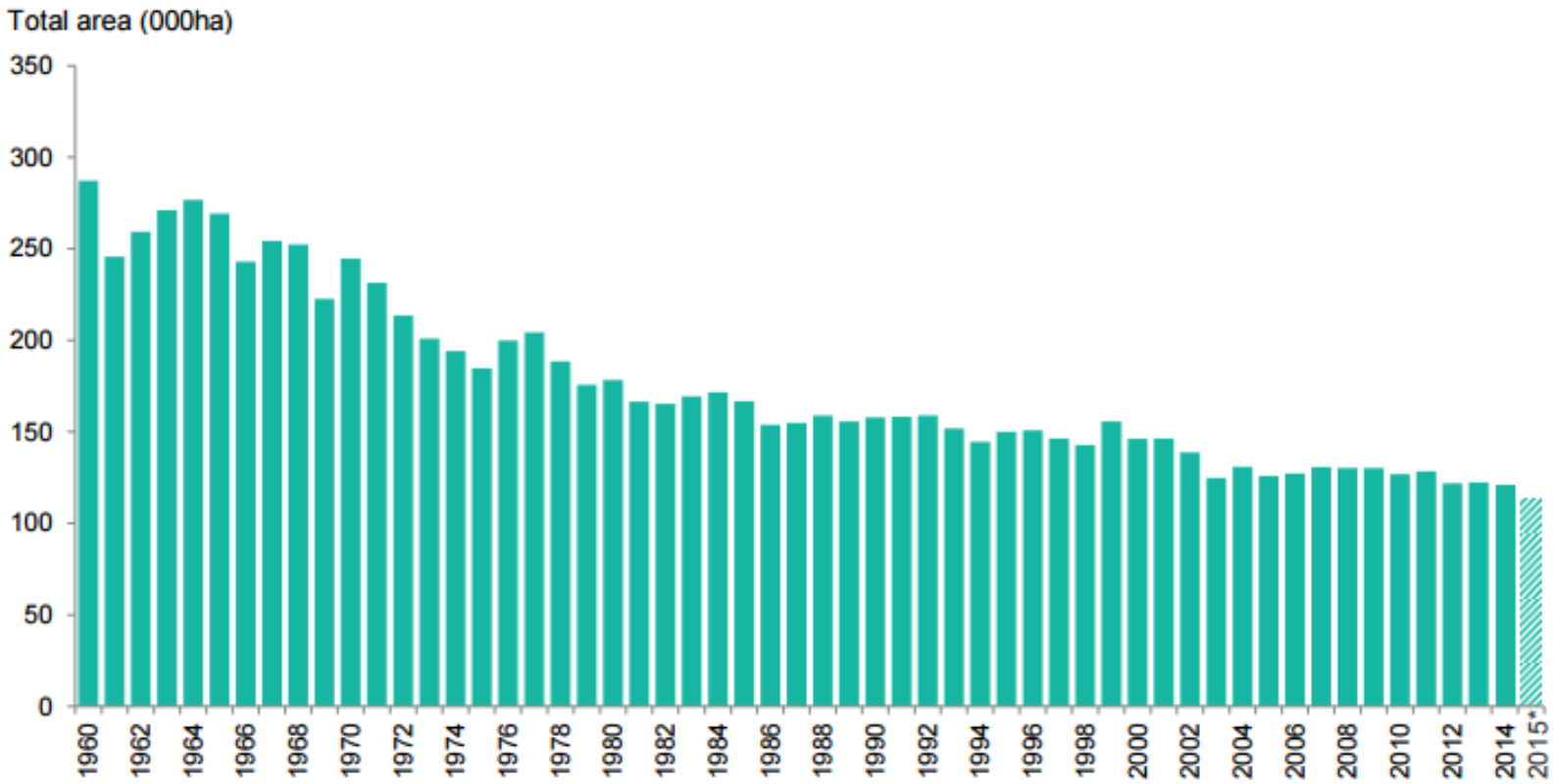


Planted Area

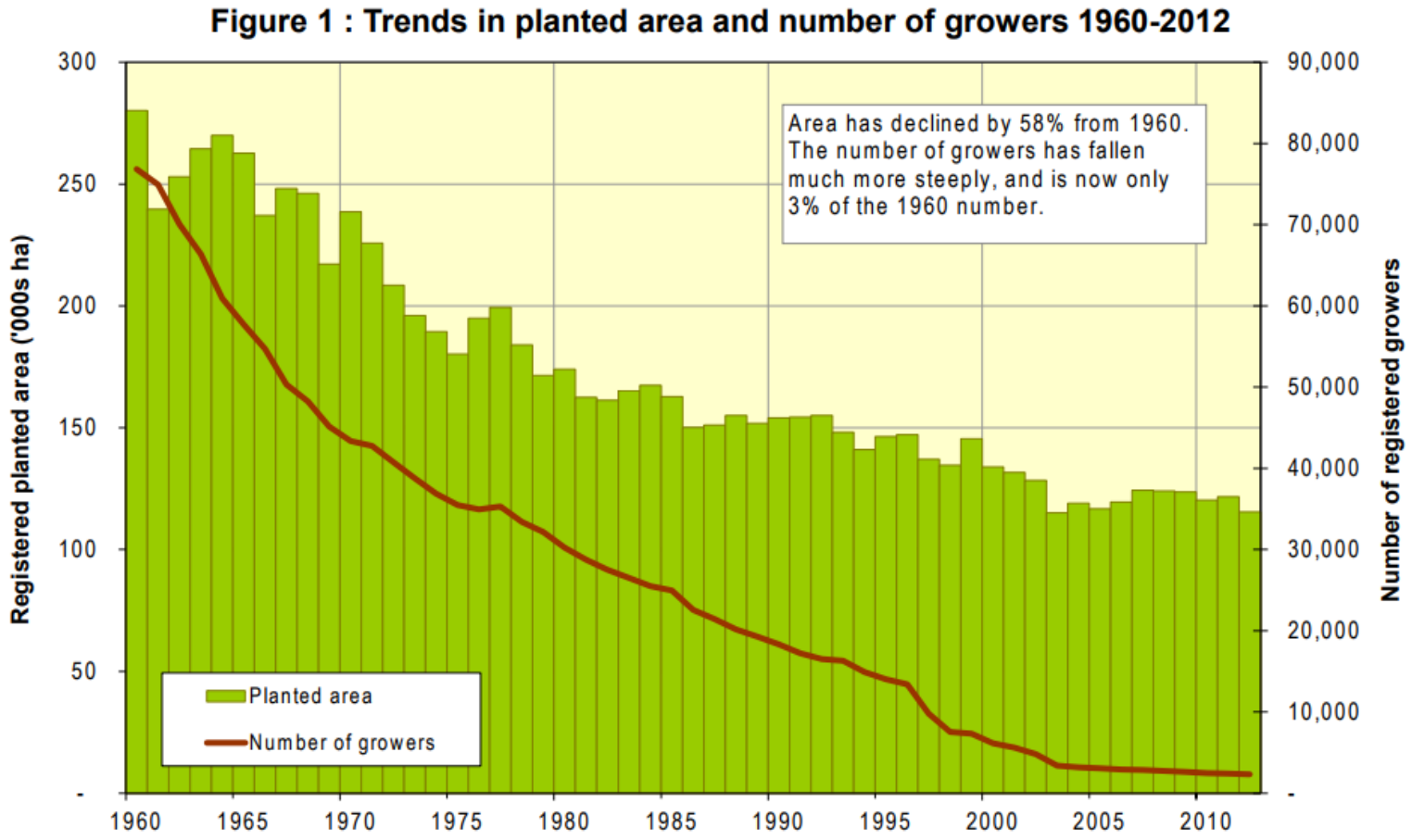
Figure 2: Planted area 1960-2015

Source: AHDB Potatoes Planting Returns

*2015 data provisional as at August 2015



Decline in number of growers



Less Growers – more work!

Figure 3: Planted area and number of growers 2000-2015

Source: AHDB Potatoes Planting Returns

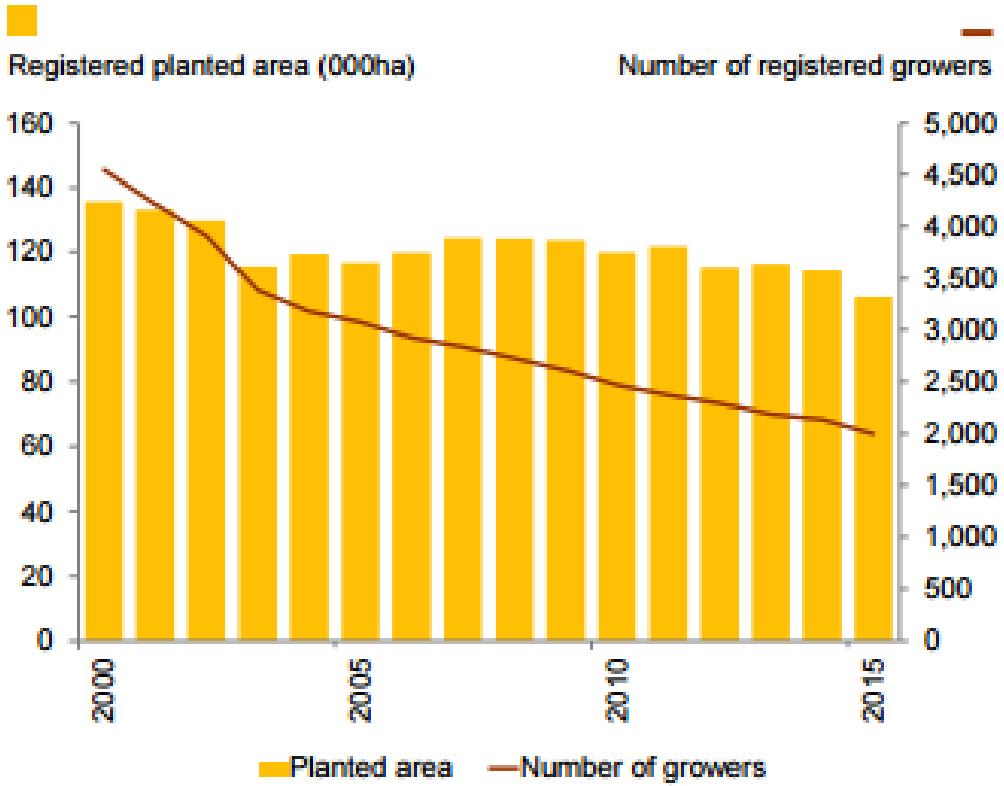
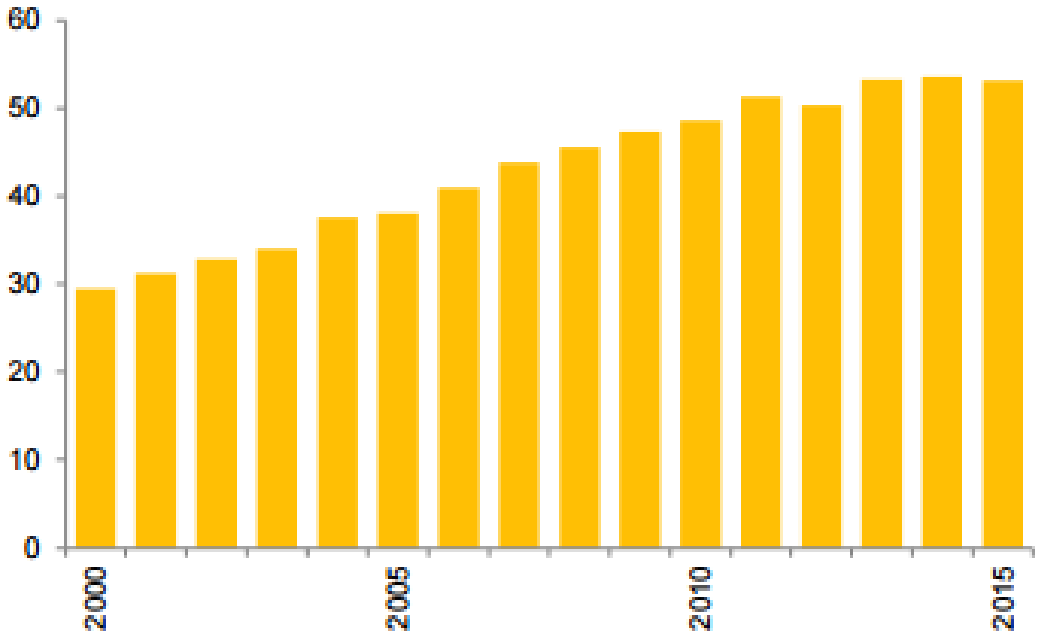


Figure 4: Planted area per grower 2000-2015

Source: AHDB Potatoes Planting Returns



Top 10 varieties grown in UK

Table 3: Top ten varieties by planted area in 2016

Source: AHDB Potatoes Planting Returns

Rank	Variety	2016 ha	Final 2015 v provisional 2016 change in rank		Proportion of GB area (%)	Principal use
1	Maris Piper	17,400	0	▶	15	Maincrop multipurpose (mainly chipping but also popular packing and bags)
2	Markies	6,100	0	▶	5	Maincrop chipping
3	Maris Peer	5,000	0	▶	4	Second early pre-pack (mainly salad or new potato)
4	Melody	3,600	+1	▲	3	Maincrop pre-pack
5	Lady Rosetta	3,600	-1	▼	3	Maincrop crisping
6	Estima	3,100	0	▶	3	Second early pre-pack
7	Pentland Dell	2,800	+1	▲	2	Maincrop chipping
8	Taurus	2,400	+6	▲	2	Maincrop crisping
9	Royal	2,400	+6	▲	2	Maincrop chipping
10	Marfona	2,400	0	▶	2	Second early pre-pack

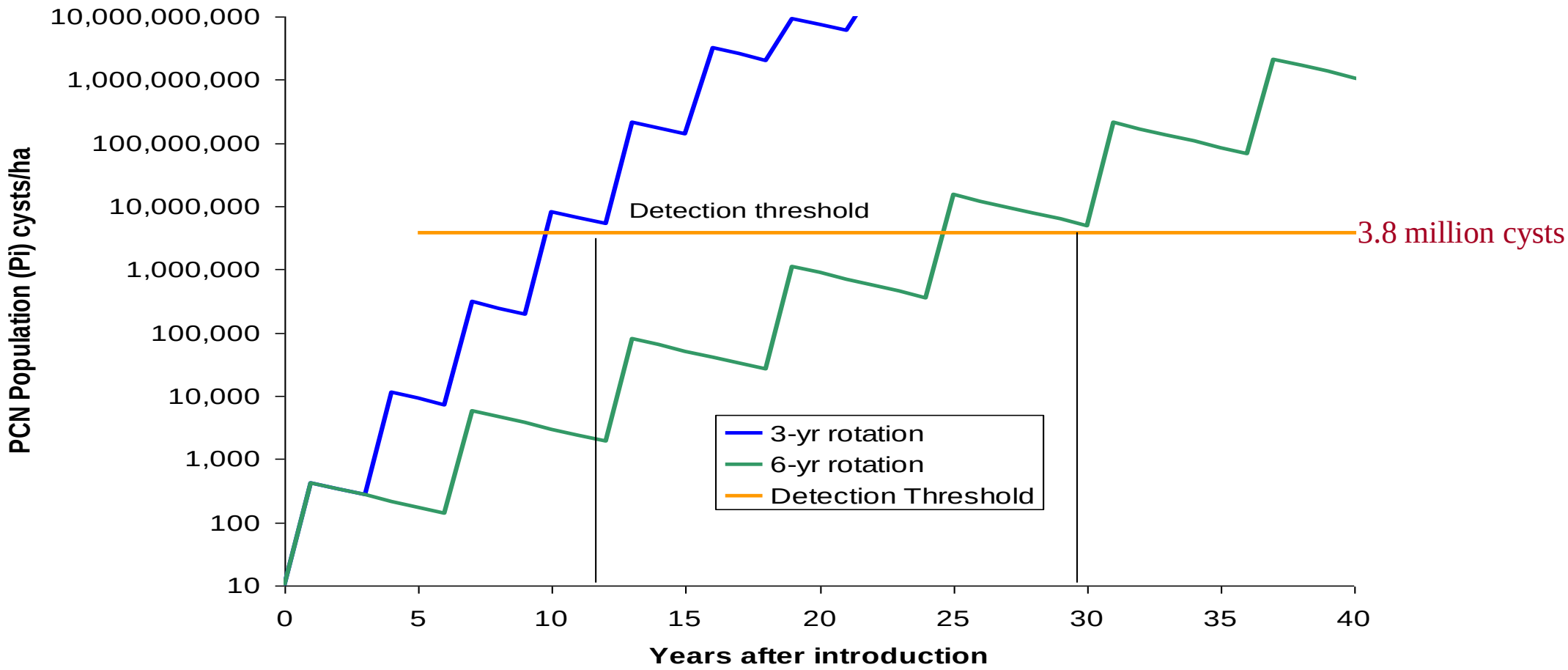
Further details of the top 50 varieties can be found here
potatoes.ahdb.org.uk/publications/update-potato-plantings-variety-great-britain-2016

The problem with PCN

PCN

- 2 Species
- Important to know which type
- Important to understand the difference between varietal tolerance and resistance
- Nematicide cost £440/ha
- Severe yield penalties – maybe not this year but maybe after the next crop

Sustainable Management of PCN in Seed Land



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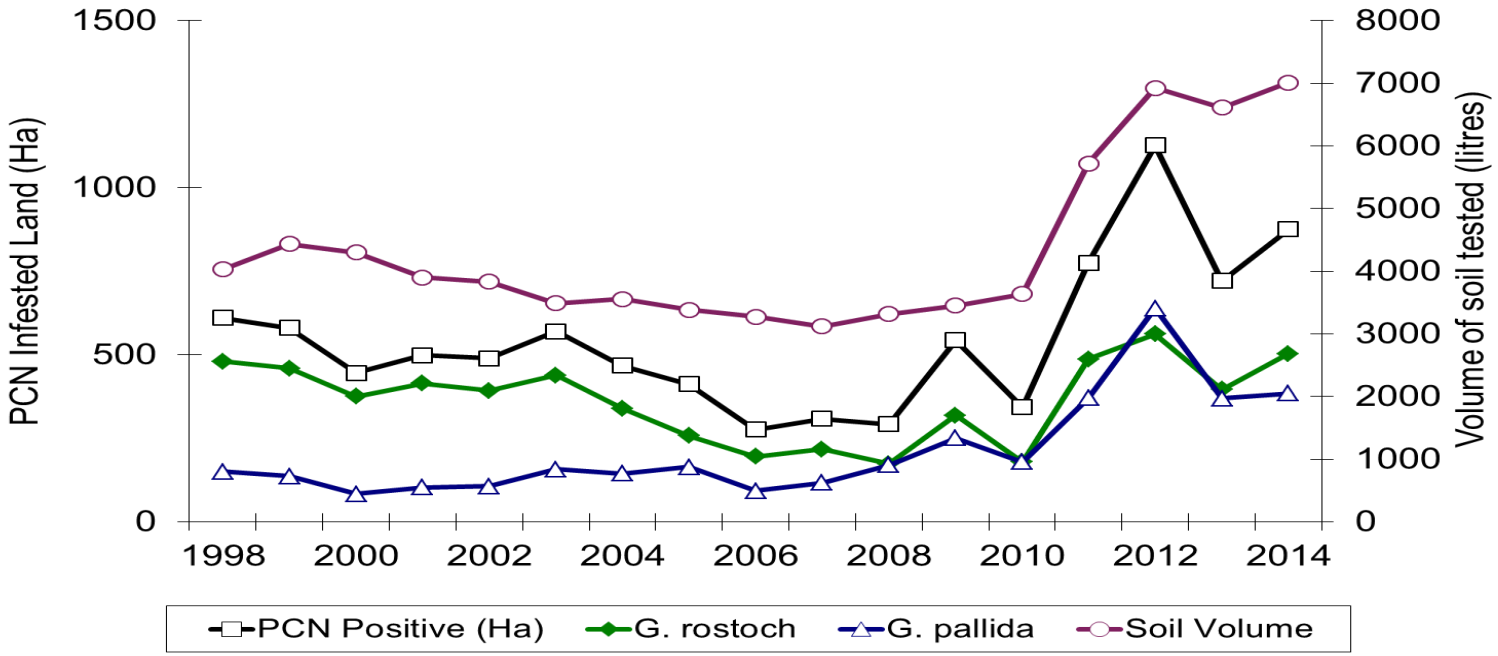
PCN – Are we looking hard enough?

The threshold of detection of PCN is 3.8 million cysts. This means that even if soil tests come back as 'None detected' there could be a relatively high population in the soil



SASA / Jon Pickup

The importance of technology – Does precision farming work for potatoes?

Precision Farming in Potatoes

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Questions

- How can we use precision technology to increase marketable yield in potatoes:
    - *PCN control*
    - *Fertiliser use*
    - *Water management*
    - *Manipulating tuber number*
    - *Soil management*

The journey which led us to explore the building blocks of the potato crop:

- Yield plateau
- Escalating costs
- Increased risk

What techniques have we been using?

•Yield mapping	*Grimme & Soil Essentials*
•Electrical conductivity	*Soil Essentials*
•Drones	*Soil Essentials & G2way Limited*
•Drip irrigation & fertigation	*Eden Irrigation*

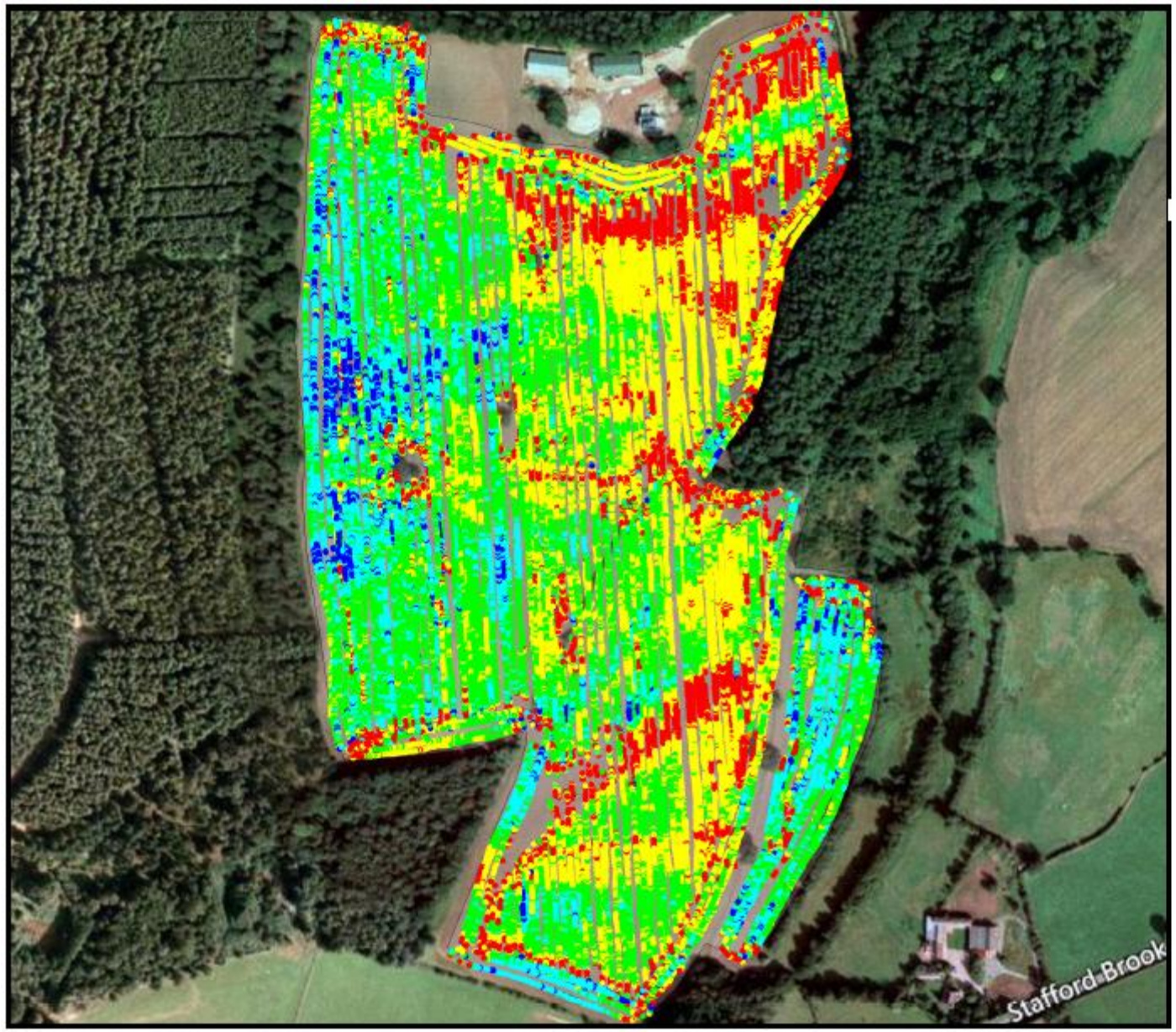
Measurement – we now have the technology to measure exactly what we do.

Lessons learnt & opportunities going forward...

Timeline

2012 - Grimme Tectron harvester with yield mapping

Potato Yields 2012



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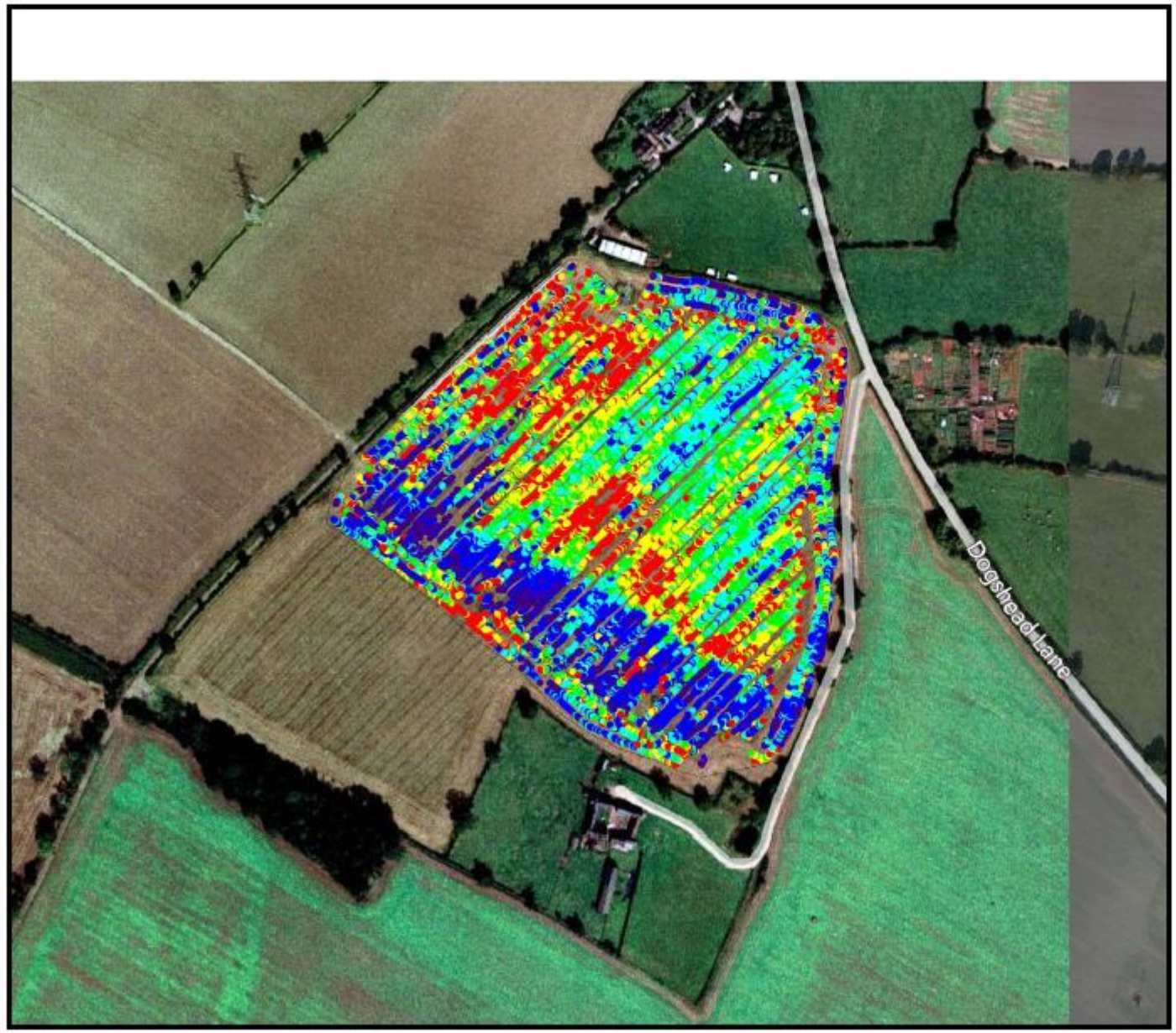
BonthRB - 2012 Potato

Yield(tne/acr)



21.958 - 502.571
16.133 - 21.957
13.182 - 16.132
10.881 - 13.181
8.154 - 10.880
3.210 - 8.153
-38.345 - 3.209

Client: James Daw
Farm: Woodhouse
Field: BonthRB
Crop: 2012 Potato
Name: field28-good
Date: 15/02/2013
Min: -38.345
Max: 502.571
Avg: 14.946

N

0 50 100
meters

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FARM WORKS

2013

Huge variation in yields across fields in 2012

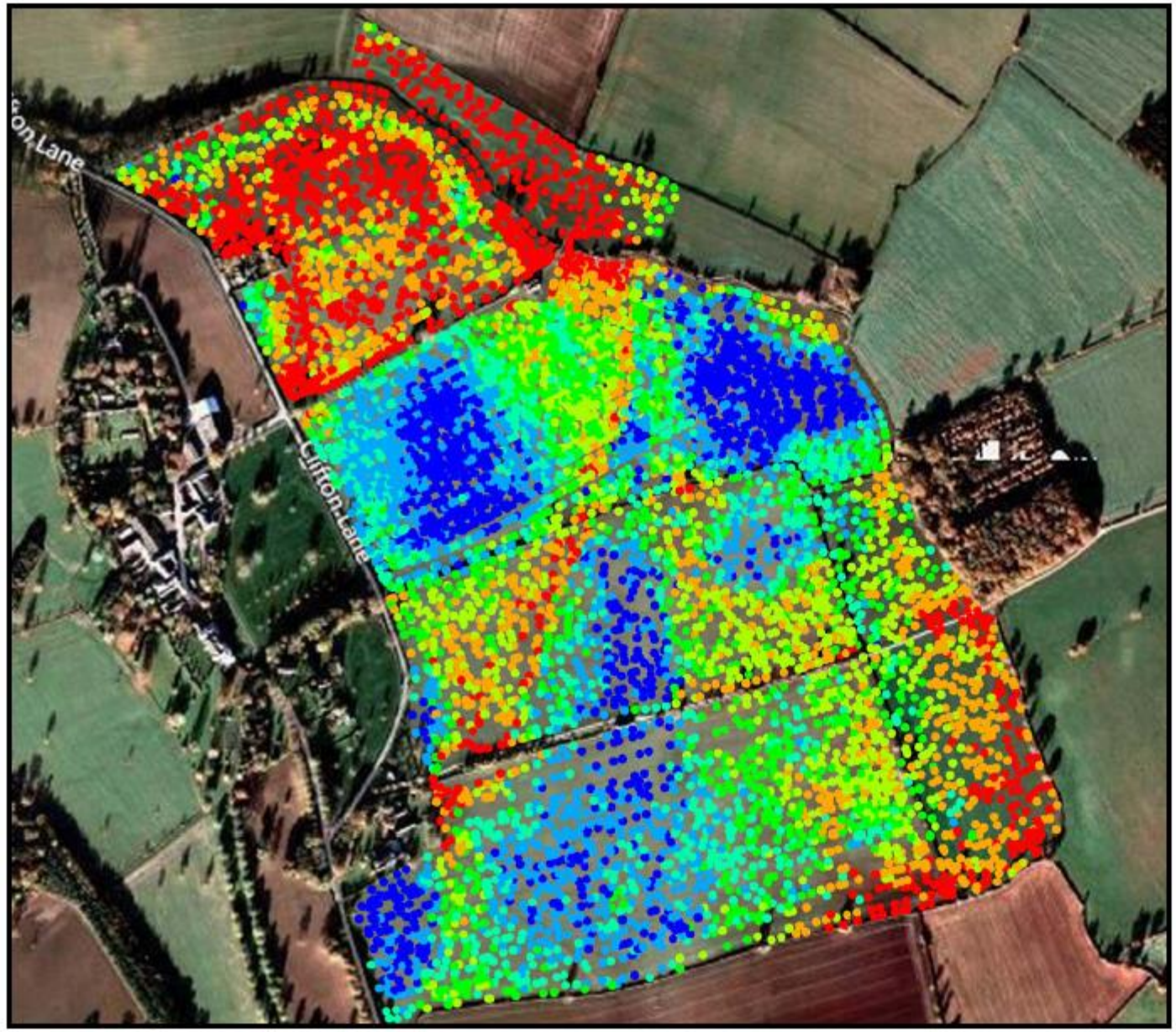
Things to put in place to understand this variability:

- *Electrical conductivity*
- *Variable fertiliser rates*
- *Variable seed spacing*
- *Zoning of water*

- *What equipment do we use?*

2013AllFields - 2013 Potato

Electrical Conductivity (EC)



Heavy

Light

Client: James Daw
Farm: Woodhouse
Field: 2013AllFields
Crop: 2013 Potato
Name: dawmarch2013b_pts
Date: 22/03/2013
Min: -816.0 ppm
Max: 949.0 ppm
Avg: 254.4 ppm

N

0 150 300
meters

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FARM WORKS

Thorpe26 - 2013 Potato: Application

TSP

Client: James Daw
Farm: Woodhouse
Field: Thorpe26
Crop: 2013 Potato
Name: Thorpe26 -TSP Applicati
Type: Application
Date: 24/04/2013
TSP: 2.854 tonnes
Unit Cost: £400.00/t
Product Cost: £1,141.60

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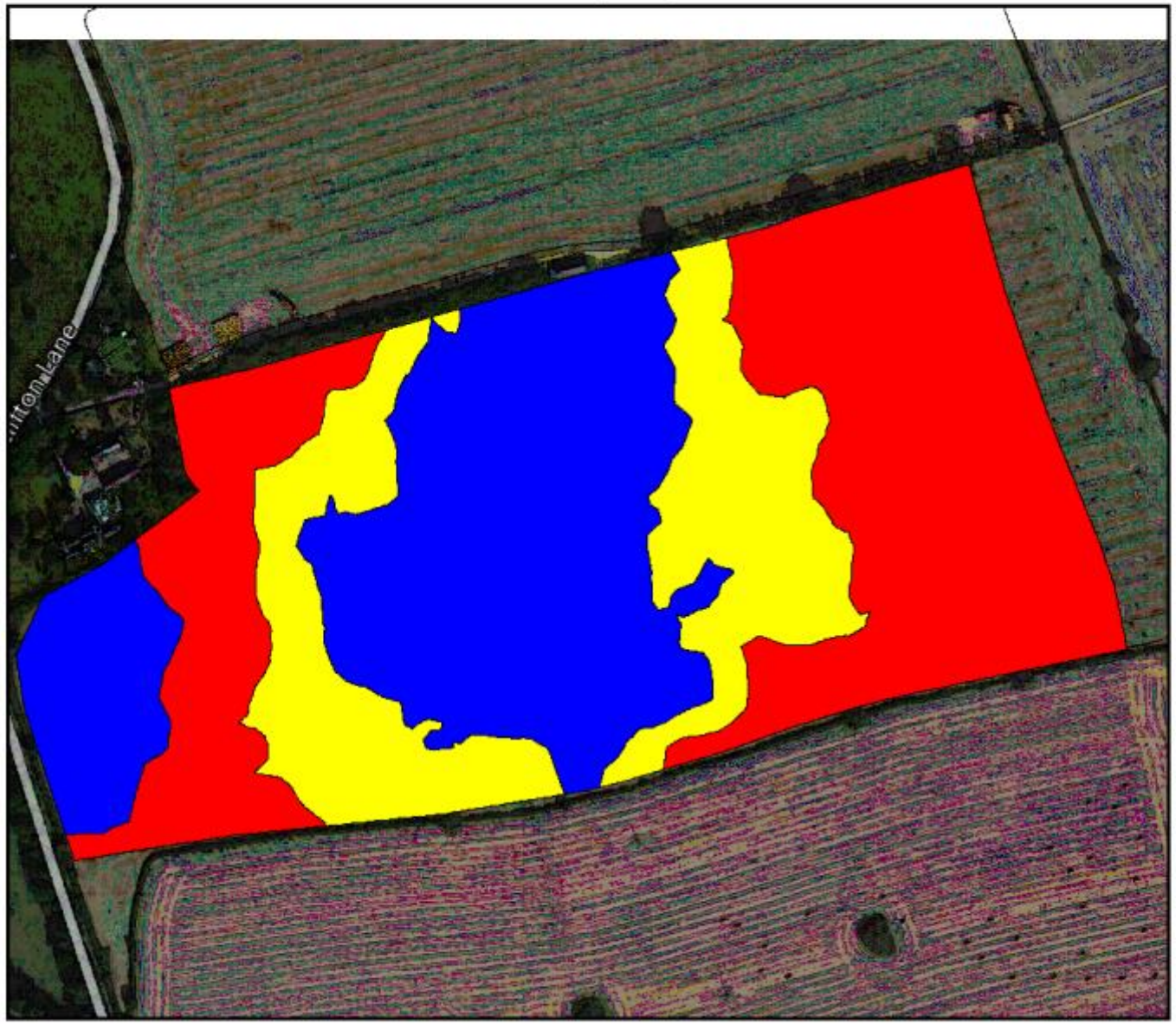
FARM WORKS

Thorpe26 - 2013 Potato: Application

Potato Spacing



Client: James Daw
Farm: Woodhouse
Field: Thorpe26
Crop: 2013 Potato
Name: Thorpe26 - PotatoApplic
Type: Application
Date: 24/04/2013
Potato Spacing: 0.037 tonnes
Unit Cost: £0.54/t
Product Cost: £0.02

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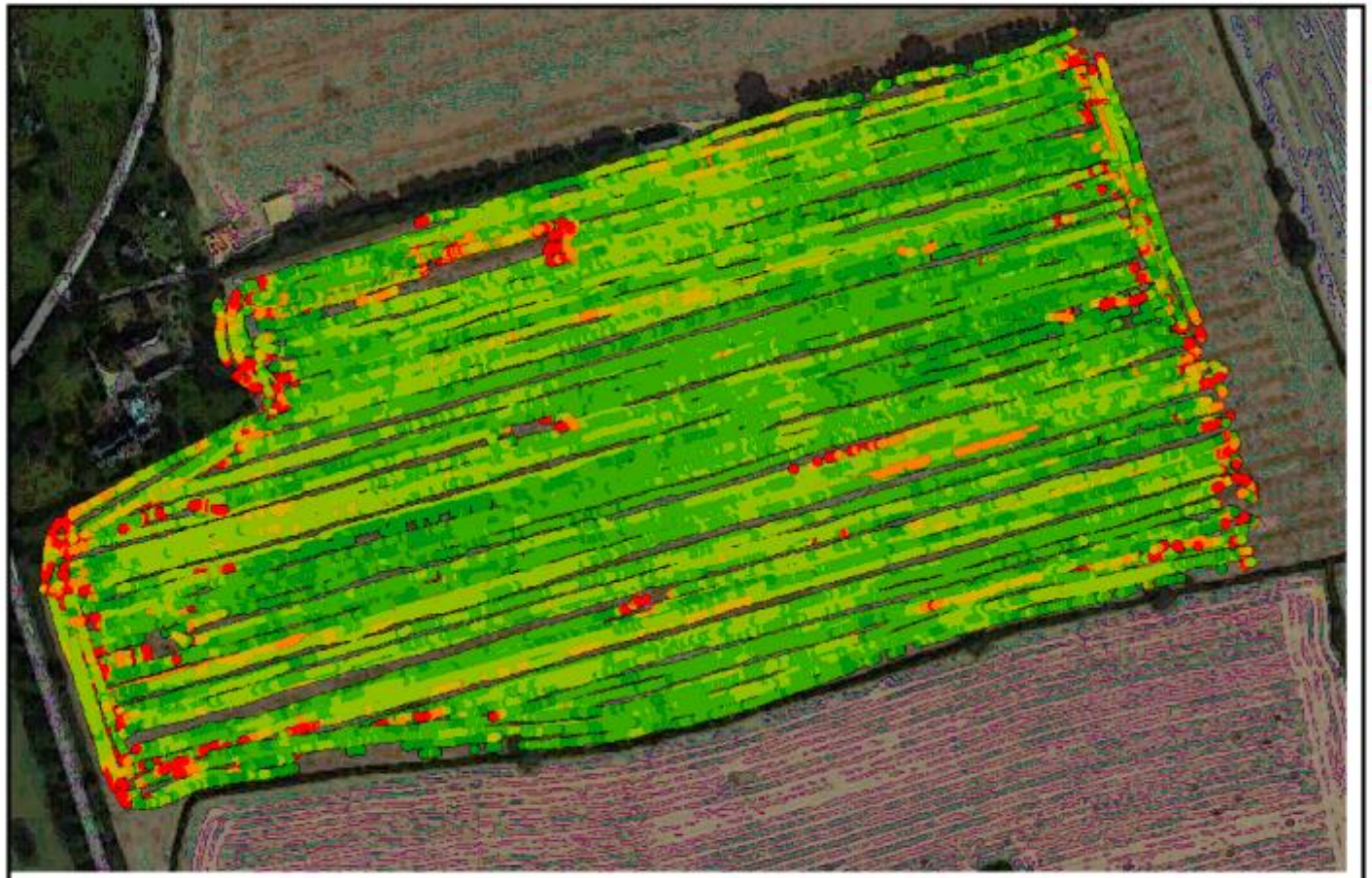
FARM WORKS

2013 Potato

Potato Yield



- Above 29.999 ton/ac
- 25.000 - 29.999 ton/ac
- 20.000 - 24.999 ton/ac
- 15.000 - 19.999 ton/ac
- 10.000 - 14.999 ton/ac
- 5.000 - 9.999 ton/ac
- 1.001 - 4.999 ton/ac

Client: < Unassigned Client >
Crop: 2013 Potato
Name: field10 good
Date: 01/02/2014
Min: 1.001 ton/ac
Max: 29.996 ton/ac
Avg: 19.211 ton/ac

N

0 50 100
meters

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FARM WORKS

2014

- Spacing
- Fertiliser
- Zoning for irrigation & fertigation
- CUF depth of work trial
- PCN - *yield comparison x 2 varieties with Pa resistance*
- Drones

Bonthorne

Electrical Conductivity (EC)

High Clay Content

Low Clay Content

Client: James Daw
Farm: Thorpe
Field: Bonthorne
Name: bonthorne_pts
Date: 16/03/2014
Min: -83.0 ppm
Max: 108.0 ppm
Avg: 21.6 ppm

N

0 100 200
meters

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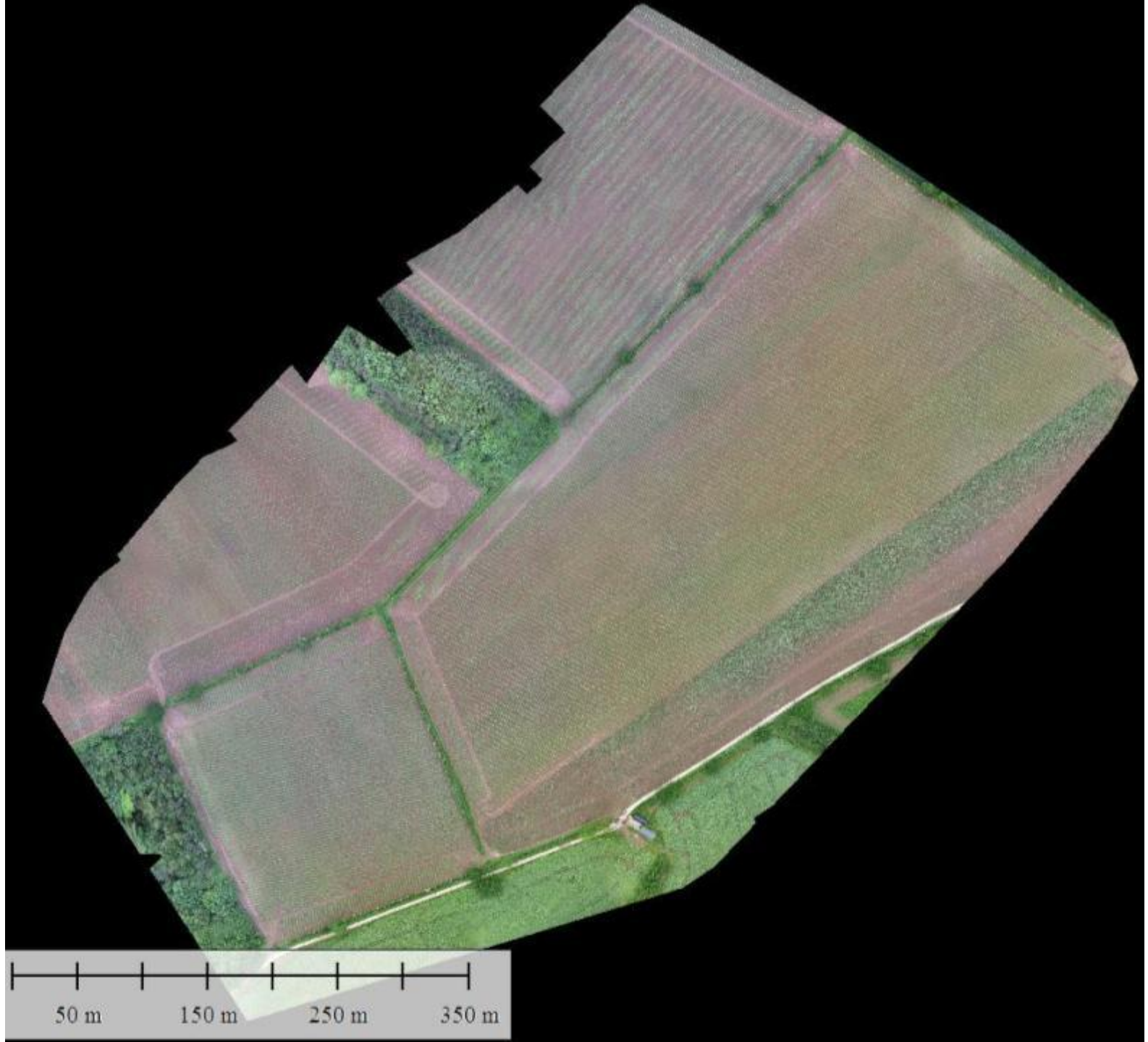
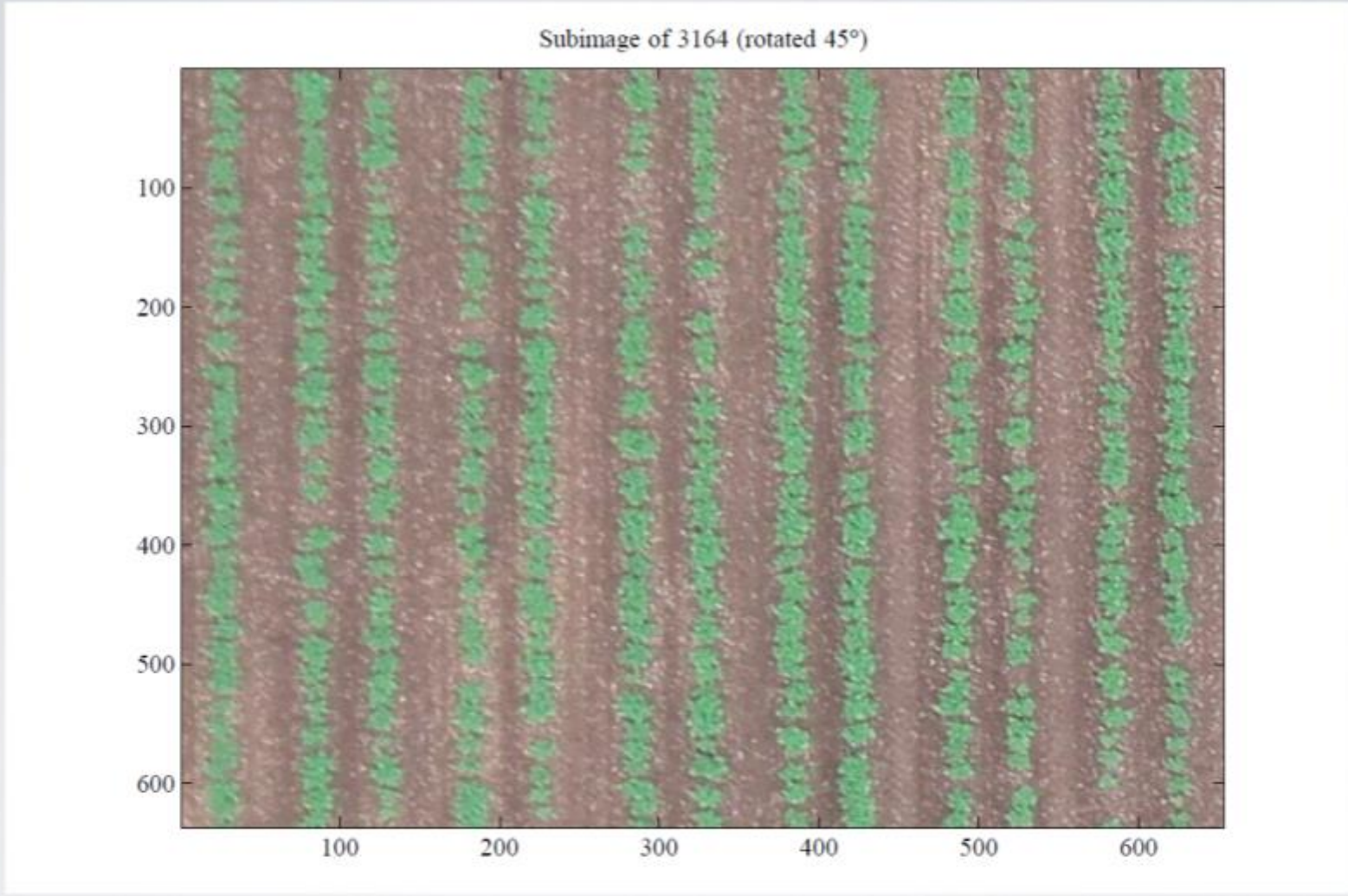
precision farming solutions

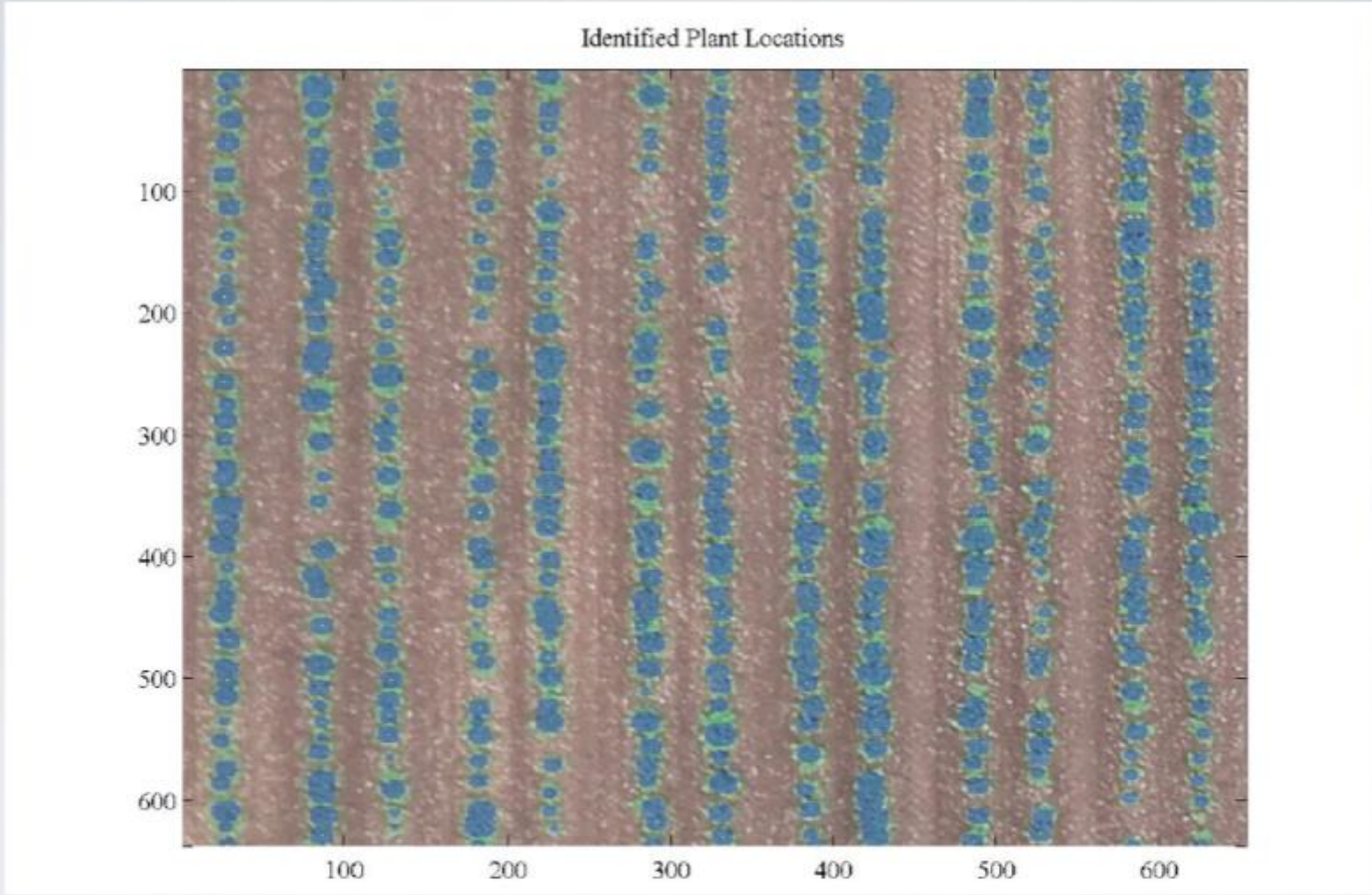
Drones


50 m
150 m
250 m
350 m



SUBIMAGE USED FOR DEVELOPMENT

Hand Count: 450 Plants



AUTOMATED RESULTS

Automated Count: 450 plants

2015

- AHDB Potatoes Spot Farm trial site
  - Seed spacing
  - Irrigation Scheduling
  - Precision Potatoes using drones
  - Crop variability
  - Water run off
  - In Field Greening
  - Primary and secondary cultivations
  - Soil Management
  - Nutrient Planning

What there is to see

Principles of obtaining seed rates

A look at how best to optimise seed rates for different varieties and the effect tuber size, the chronological age of the seed can have on stem numbers and achieving target yields.

Nutrient planning

Comparison of adjustments for manure use and previous cropping and no adjustments

See page 6 for more detail.

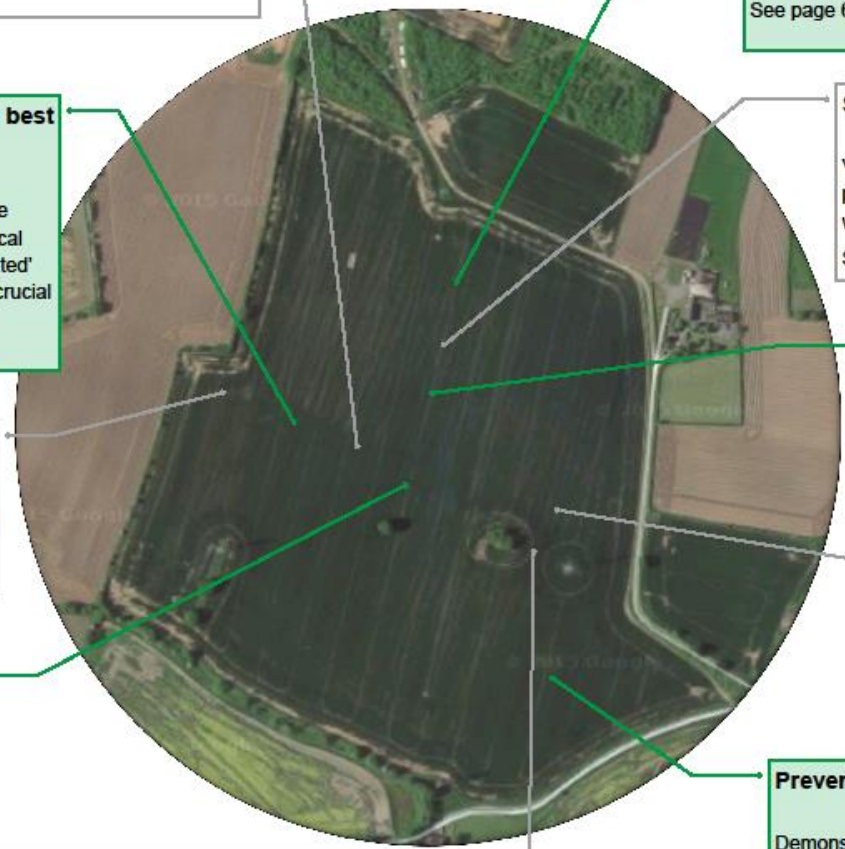
Discussion forum around the principles and best practice of irrigation scheduling

Irrigation applied to the site is being scheduled using the NIAB-CUF Irrigation Model using data collected from local weather stations and the CanopyCheck app. A 'droughted' area will demonstrate the effect of missing irrigation at crucial stages.

Soil management

Variable depth bedforming, destoning and bed tilling practices and an exploration of the impacts on yield, work rates and costs.

See page 6 for more detail.



Primary and secondary cultivations comparisons

Including use of a plough and Simba SL

See page 6 for more detail.

Precision in potatoes

A look at the innovations and technology James is implementing from drones and soil scanning to yield mapping.

In-field greening

AHDB Potatoes Fellowship work studying in-field greening in relation to planting depth and locations of tubers within the ridge in different varieties.

Crop variability

CUPGRA-sponsored PhD investigating factors affecting crop variability including between- and within-plant variation and effect of varying plant spacing.

Preventing run-off

Demonstrations of various tramline and bed profile management tools on sloped ground. Including:

- Richard Lapage Wonder Wheel
- Briggs Tied Ridger
- Aqua Agronomy Creyke 'The Wheel Tracker Roller'

The use of weather stations and soil moisture probes in potato production

A chance to discuss the data type and collection and the possibilities for their use on-farm.

Strategic Potato Farm

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Soils & Cultivations

- What do we want from a seed bed?
- Do machinery operators understand what it is they are trying to achieve?
- Give them the tools and understanding of what is required

Soils & Cultivations

- The role of cover crops
  - What do you want from a cover crop?
    - Green manure
    - Organic matter
    - Control of pests

Cover Crops

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Final Report

Managing cultivations and cover crops for improved profitability and environmental benefits in potatoes

Ref: R444

Reporting Period: April 2011 – March 2015

Report Authors: Martyn Silgram and Diana Williams, ADAS
Stuart Wale and Roger Griffin-Walker, SRUC

Date report submitted: 19 May 2015 (Updated 31 August 2015)

Report No.:2015/7

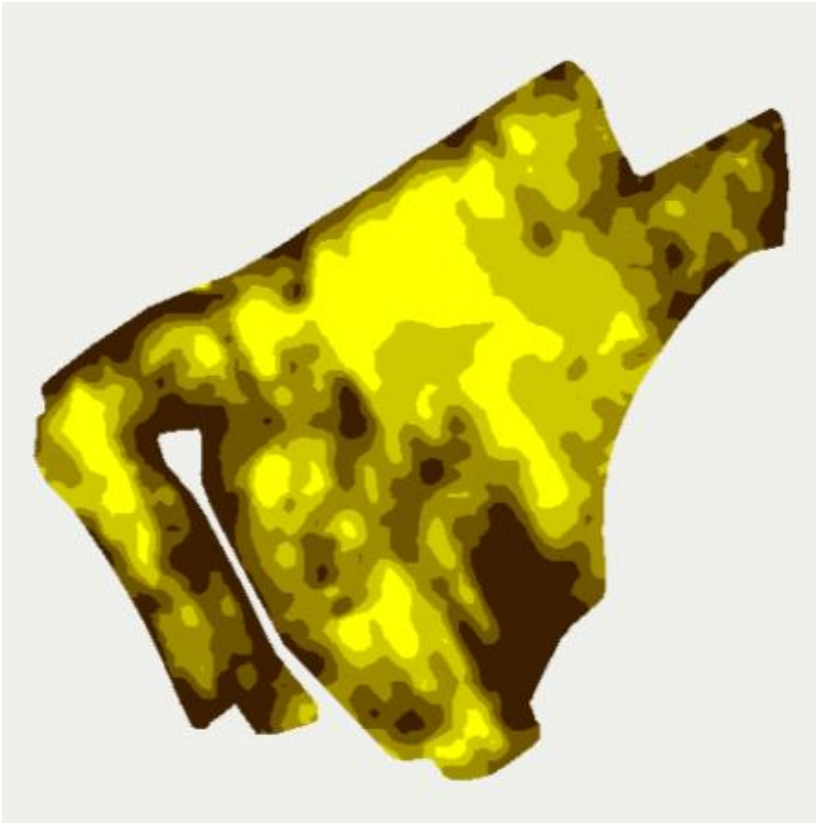
AHDB

https://potatoes.ahdb.org.uk/publications/r444-managing-cultivations-and-cover-crops

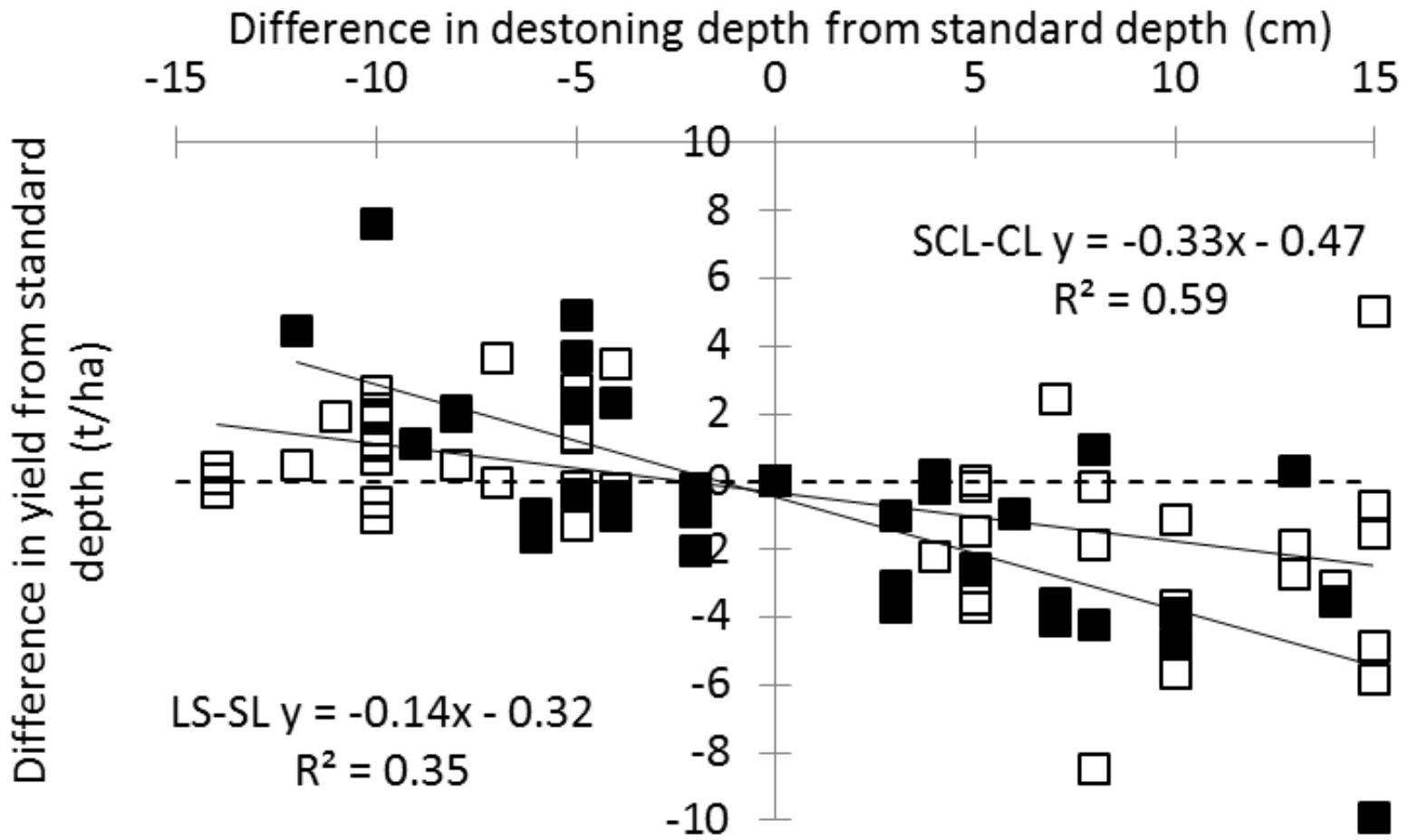
Flexibility of primary/secondary cultivations

- Can you plough on top?
- Can you use a tine instead of a powered rotary cultivator?
- Do you need to plough at all?

Variable depth cultivations



Depth vs yield: all 2011-2013 sites



SPot Farm (comments from James Daw)

Cultivations

Cultivations have been a key area of investigation. Working with NIAB CUF research scientist Mark Stalham, cultivation depths have been significantly reduced, resulting in big fuels savings with no loss of yield.

The work compared various cultivations at standard farm practice (around 45cm from top of ridge to the base) and the best practice depth, which was 6 cm shallower.

Overall, this resulted in a slight yield lift (1%), a 2% increase in tuber length fraction and a 35% saving in fuel + labour costs. This was helped by the removal of the bedtiller operation, which was surplus to requirements at the shallower depth, and a 4% increase in the slowest operation (destoning).

"The key thing is understanding the depth you are working," said Mr Daw. "Hands up. I worked my soils far too deep – I thought the deeper you went the better.

"No it isn't. You are pulling up cold soils, bringing up clods. Shallower is better. Will I go as far as Mark wants me to? No, not quite. I need that little bit of cushion over and above Mark's little bit of cushion.

"But we are saving 25-30% fuel through compared to where we were. That's a massive cost saving. I've fed all this back to my staff. They get it – they understand it."

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Reducing water run-off

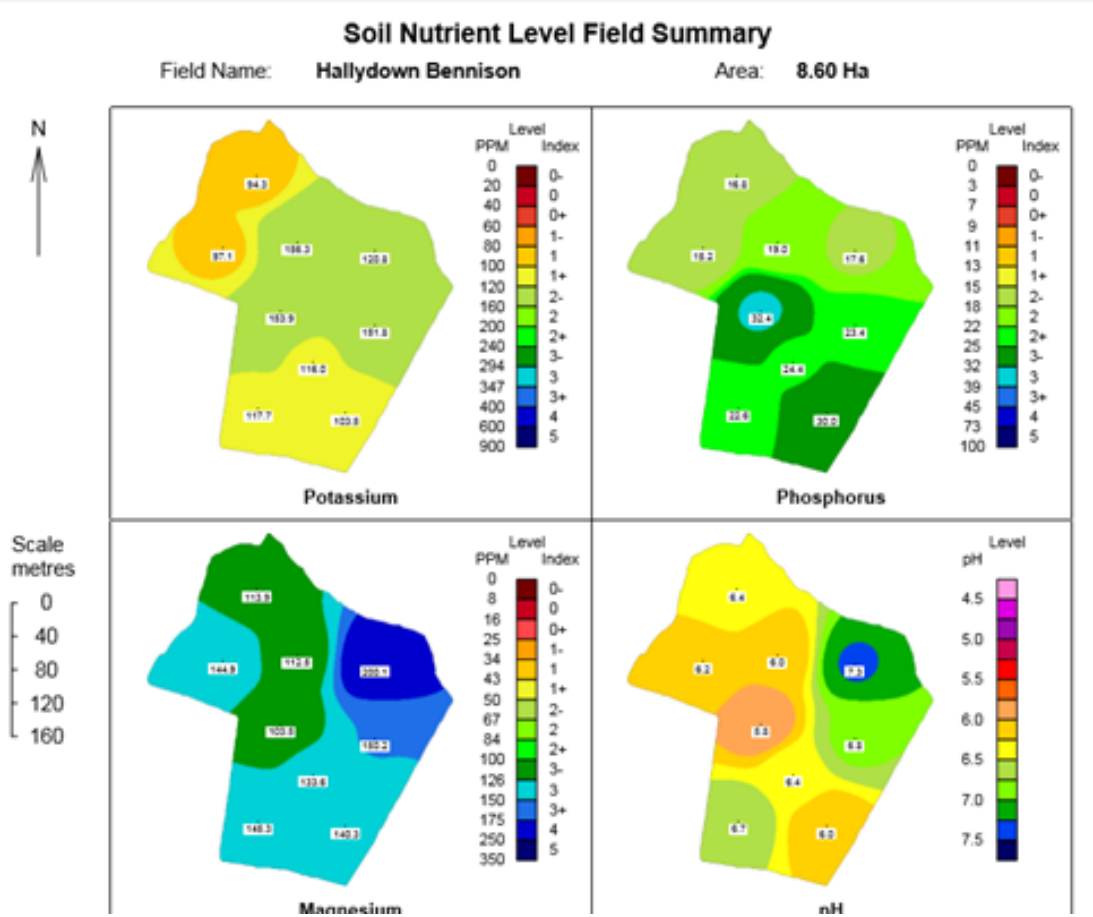

Water the biggest concern going forward

Nutrition

- Is Sulphur important?
  - Assists with efficient utilisation of N and is involved with chlorophyll production, has been shown to influence acrylamide levels
- Should we be looking at more detailed soil analysis?
  - Is what is extracted in the lab all plant available?
- Opportunities for the use of FYM, Compost, Digestate
  - What is available to the plant?
- Foliar feeds and Biostimulants – do they have a part to play
  - Lack of good replicated trial data

Using technology to apply nutrients

- 60% of land growing potatoes is rented
- Why apply more than is necessary?
- Fertigation not an option
- Challenges – particularly with availability of P



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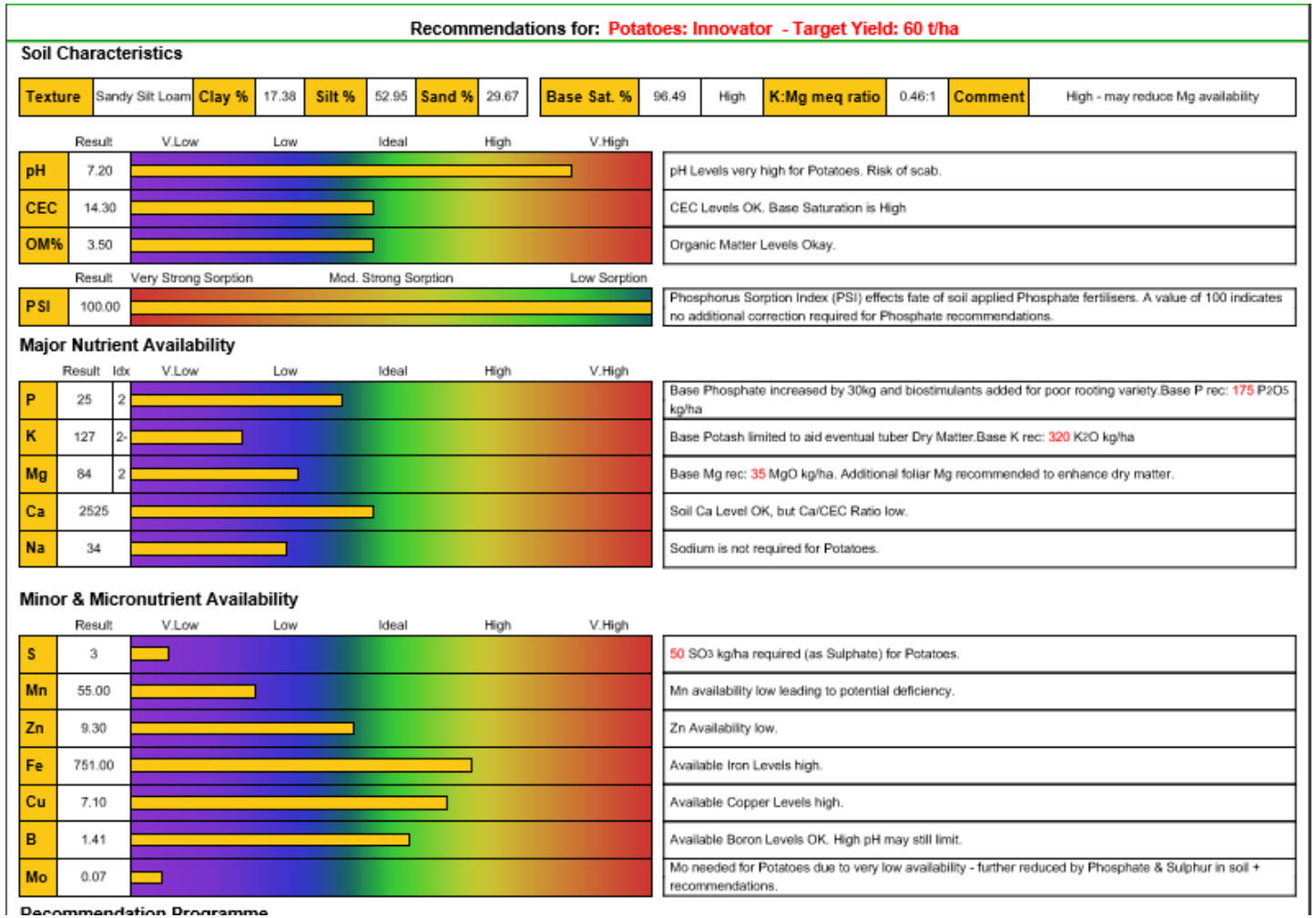
Phosphorus

- Why phosphate application as close to planting as possible is vital

Crop	**Root length** (in top 20 cm) km root per m^2 of topsoil
Winter wheat	24.4
Winter OSR	19.4
Spring barley	8.4
Potato	3.8
Broad bean	1.6

Soil Analysis

- More detail
- Phosphorus sorption
- Texture
- CEC
- OM%



Recommendations for: Potatoes: Innovator - Target Yield: 60 t/ha

Soil Characteristics

Texture	Sandy Silt Loam	Clay %	17.38	Silt %	52.95	Sand %	29.67	Base Sat. %	96.49	High	K:Mg meq ratio	0.46:1	Comment	High - may reduce Mg availability

	Result	V.Low – Low – Ideal – High – V.High	
pH	7.20		pH Levels very high for Potatoes. Risk of scab.
CEC	14.30		CEC Levels OK. Base Saturation is High
OM%	3.50		Organic Matter Levels Okay.

	Result	Very Strong Sorption – Mod. Strong Sorption – Low Sorption	
PSI	100.00		Phosphorus Sorption Index (PSI) effects fate of soil applied Phosphate fertilisers. A value of 100 indicates no additional correction required for Phosphate recommendations.

Major Nutrient Availability

	Result	Idx	V.Low – Low – Ideal – High – V.High	
P	25	2		Base Phosphate increased by 30kg and biostimulants added for poor rooting variety.Base P rec: 175 P_2O_5 kg/ha
K	127	2-		Base Potash limited to aid eventual tuber Dry Matter.Base K rec: 320 K_2O kg/ha
Mg	84	2		Base Mg rec: 35 MgO kg/ha. Additional foliar Mg recommended to enhance dry matter.
Ca	2525			Soil Ca Level OK, but Ca/CEC Ratio low.
Na	34			Sodium is not required for Potatoes.

Minor & Micronutrient Availability

	Result	V.Low – Low – Ideal – High – V.High	
S	3		50 SO_3 kg/ha required (as Sulphate) for Potatoes.
Mn	55.00		Mn availability low leading to potential deficiency.
Zn	9.30		Zn Availability low.
Fe	751.00		Available Iron Levels high.
Cu	7.10		Available Copper Levels high.
B	1.41		Available Boron Levels OK. High pH may still limit.
Mo	0.07		Mo needed for Potatoes due to very low availability - further reduced by Phosphate & Sulphur in soil + recommendations.

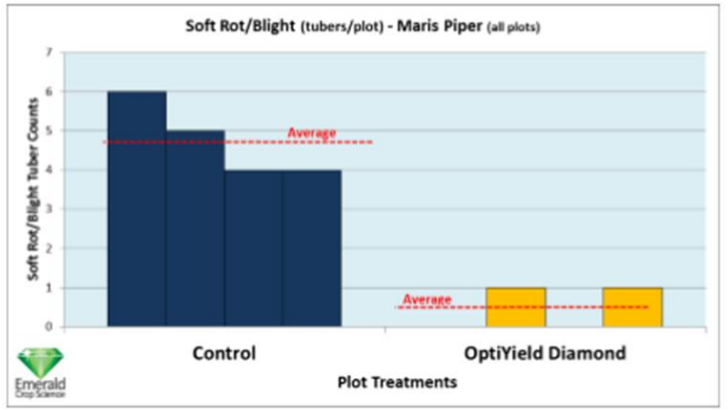
Recommendation Programme

Bio-stimulants and plant health

Replicated OptiYield biostimulant trials (2013)
Henfaes Research Station, University of Bangor

Maris Piper – Untreated (Control)

Maris Piper – Treated (OptiYield Diamond)



Foliar Nutrition Trial (courtesy of Intracrop)

Foliar Nutrition Trial in Potatoes

Location, West Heslerton, North Yorkshire
Crop, Potatoes. Variety, Shelford

Yield Data 29.09.15

Yield Data t/ha by size fraction P =<0.05

Treatment Number	26.06.15	17.07.15	06.08.15	19.08.15	<45mm	45-65mm	65-85mm	Total	Marketable
1	Untreated	Untreated	Untreated	Untreated	2.48 a	39.41 c	16.02 a	57.91 b	55.43 b
2	Uplift 3 l/ha	Uplift 3 l/ha	Uplift 3 l/ha	Uplift 3 l/ha	2.91 a	48.53 ab	14.16 a	65.59 a	62.68 a
3	Uplift R100 3 l/ha	Uplift R100 3 l/ha	Uplift R100 3 l/ha	Uplift R100 3 l/ha	2.91 a	49.94 a	13.47 a	66.31 a	63.40 a
				LSD	0.608	5.537	5.803	5.878	5.281
				cv%	24.74	7.62	24.67	5.84	5.49

Percent yield response by size fraction P = <0.05

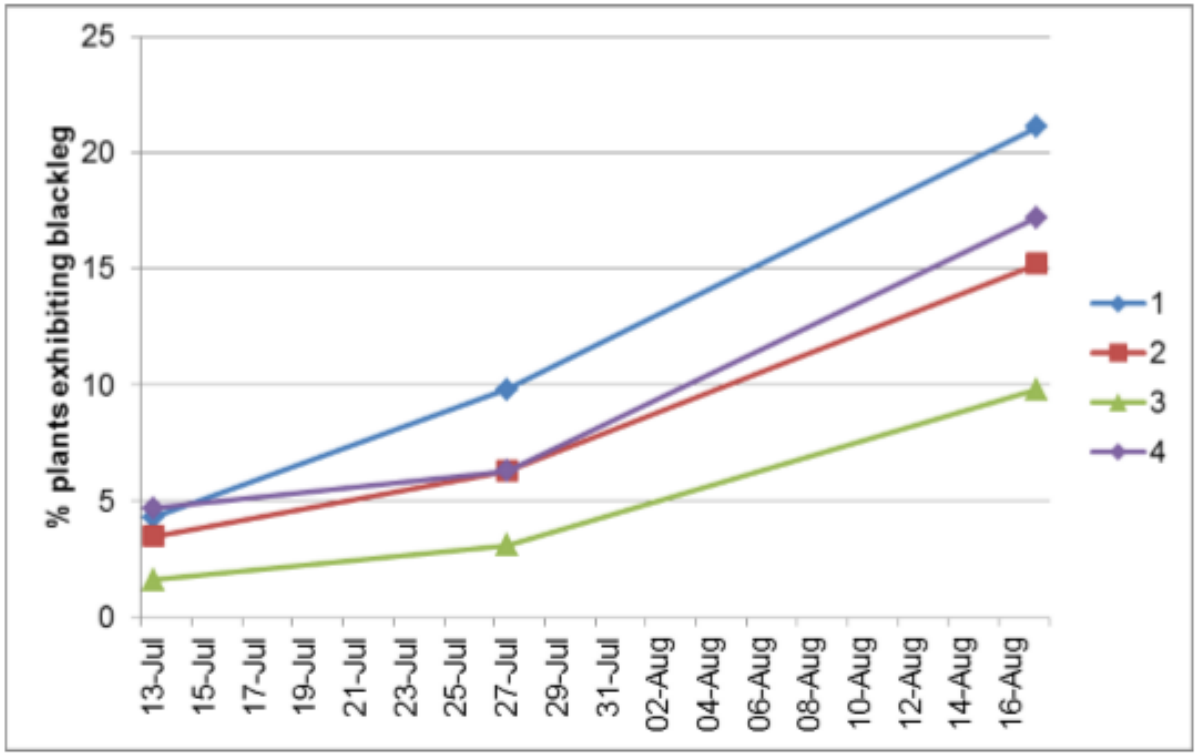
Treatment Number	26.06.15	17.07.15	06.08.15	19.08.15	<45mm	45-65mm	65-85mm	Total	Marketable
1	Untreated	Untreated	Untreated	Untreated	100.00 a	100.00 b	100.00 a	100.00 b	100.00 c
2	Uplift 3 l/ha	Uplift 3 l/ha	Uplift 3 l/ha	Uplift 3 l/ha	120.79 a	125.19 a	91.82 a	113.39 a	113.17 a
3	Uplift R100 3 l/ha	Uplift R100 3 l/ha	Uplift R100 3 l/ha	Uplift R100 3 l/ha	128.33 a	130.61 a	89.60 a	115.18 a	114.87 a
				LSD	47.067	20.296	30.875	10.713	9.996
				cv%	24.67	10.80	20.04	6.15	5.75

Uplift R100™ formulation is covered by UK and European patents. Worldwide patents have been applied for

Plant Elicitors

- Q. What is an elicitor?

- A. It is a material that enhances host resistance (not a pesticide but an enhancer of plant health and production)
- In this case a protein called Harpin (sold as ProAct) aimed to assist with the control of Blackleg

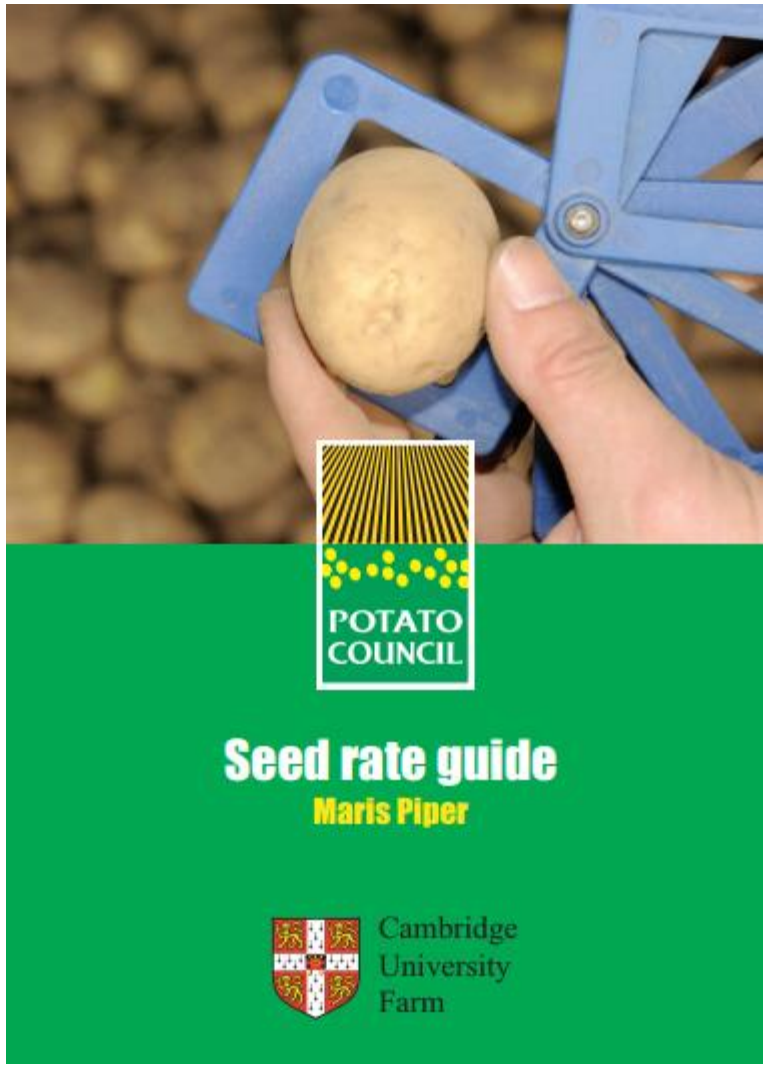


Treatment 1 is the Untreated control.
Treatment 2 is ProAct seed tuber treatment followed by 3 foliar applications of ProAct.
Treatment 3 is 5 foliar applications of ProAct from 50% emergence.
Treatment 4 is 3 foliar applications of ProAct from 50% emergence.

Seed

- Field and variety selection is crucial
- If new varieties are going to take off the Grower and Agronomist need to be supplied with some basic variety management guidelines
- Seed spacing and nutrition advice at the very least

Seed



Seed rate guide for Maris Piper for specified yield with a target average tuber size of 60mm† and a planting date of 15 April

Tuber count / 50kg	Yield (t/ha) 55 ‡ Plant density (000/ha)	55 ‡ Seed rate (t/ha)	60 Plant density (000/ha)	60 Seed rate (t/ha)	65 Plant density (000/ha)	65 Seed rate (t/ha)	70 Plant density (000/ha)	70 Seed rate (t/ha)
Early seed (emerged 1 May)								
2400	42	0.88	48	1.00	54	1.13	61	1.27
2000	39	0.99	45	1.12	51	1.27	57	1.43
1600	36	1.13	41	1.28	46	1.45	53	1.64
1200	32	1.32	36	1.50	41	1.69	46	1.92
1000	29	1.44	33	1.63	37	1.85	42	2.09
900	27	1.51	31	1.71	35	1.94	39	2.19
800	25	1.58	29	1.80	33	2.04	37	2.30
700	23	1.67	27	1.89	30	2.14	34	2.43
600	21	1.76	24	2.00	27	2.27	31	2.56
500	19	1.86	21	2.12	24	2.40	27	2.71
400	16	1.98	18	2.25	20	2.55	23	2.88
Standard seed (emerged 1 June)								
2400	49	1.02	56	1.16	63	1.32	71	1.49
2000	46	1.15	52	1.30	59	1.48	67	1.67
1600	42	1.30	47	1.48	54	1.68	61	1.90
1200	36	1.51	41	1.72	47	1.95	53	2.20
1000	33	1.65	37	1.87	42	2.12	48	2.40
900	31	1.72	35	1.96	40	2.22	45	2.51
800	29	1.80	33	2.05	37	2.32	42	2.63
700	27	1.89	30	2.15	34	2.44	39	2.76
600	24	1.99	27	2.27	31	2.57	35	2.90
500	21	2.11	24	2.39	27	2.71	31	3.07
400	18	2.23	20	2.54	23	2.87	26	3.25
Late seed (emerged 15 July)								
2400	64	1.34	73	1.52	83	1.72	94	1.95
2000	60	1.49	68	1.69	77	1.92	87	2.17
1600	54	1.68	61	1.91	69	2.16	78	2.45
1200	46	1.92	53	2.19	59	2.48	67	2.80
1000	42	2.08	47	2.36	53	2.67	60	3.02
900	39	2.16	44	2.46	50	2.78	57	3.15
800	36	2.25	41	2.56	46	2.90	52	3.28
700	33	2.35	37	2.67	42	3.03	48	3.43
600	30	2.46	34	2.80	38	3.17	43	3.59
500	26	2.58	29	2.94	33	3.33	38	3.76
400	22	2.71	25	3.09	28	3.50	32	3.95

†Average tuber size is the grade with the greatest proportion of yield. Assuming a coefficient of variation of 0.215, c. 50% of yield is 60-65mm where the average tuber size is 60mm. Yields indicated are the total tuber yields rather than marketable yields above a minimum size (where the average tuber size = 60mm, c. 5% of yield may be expected to be below 45mm).
‡Where yields <40t/ha are expected, seed rates shown in this column can be used but the average tuber size will be greater, increasing to 65mm at a yield of 70t/ha. The proportion of yield in the 60-65mm grade may be c. 60% where the tuber size average = 65mm, but a significant proportion of tubers may be oversize. For red shaded area see Step Five in main text.

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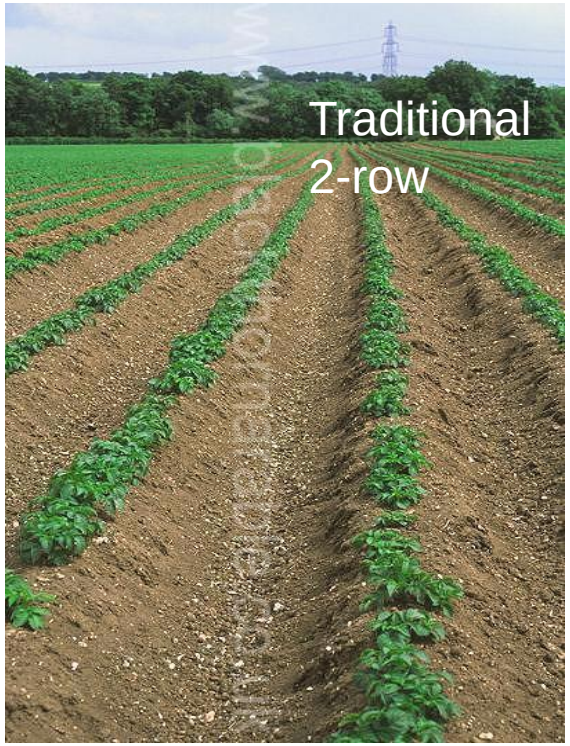
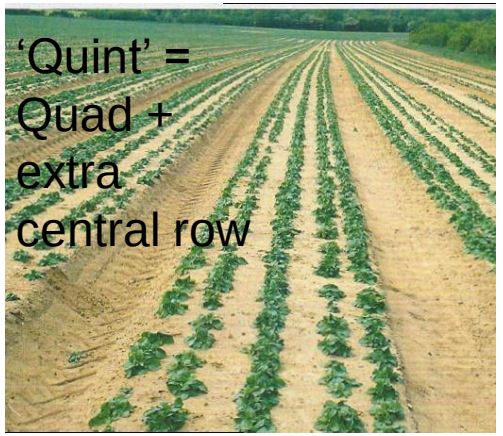
Seed

Could this improve crop variability?





Theory: Bed vs 2-Row

Squarer planting i.e. narrow row spacing

- More even use of resources
- Increased number of tubers
- More suitable for
  - Salads
  - Seed
  - Varieties with few tubers/stem or few stems

Difficult to measure differences in practice

Seed treatments

- What's available currently
  - Imazalil (Gavel)
  - Pencycuron (Monceren DS)
  - Flutolanil (RhiNo FS / RhiNo DS)
  - Fludioxonil (Maxim)

Soil Treatments

- Azoxystrobin (Amistar)
- Consortium Z (bacillus)
- Fluopyram (SDHI for FLN/PCN)
- Fluxapyyroxad (BAS700/Sercadis)

Pesticides

- Loss of actives a real issue
  - Storite Super
  - Linuron
  - Methiocarb
- Potential loss of actives even more worrying
  - Glyphosate
  - Diquat
- Product label changes
  - Buffer zones
  - Number of applications

Pesticides

- Will Brexit mean that UK will have access to products available in other parts of the world?
  - Seed and in-furrow treatments [Emesto Prime (penflufen)]
  - Powdery scab control [Nebijin (flusulfamide)]

- On the plus side there are some new products slowly edging their way towards market
  - Blight product from DowDupont – for 2018 (ZORVEC)
  - Aphicide from DowDupont – for 2018 (ISOCLAST ACTIVE)
  - Nematicide from Bayer – for 2018 (VELUM)
  - Sprout suppressant from BASF - ? (DMN)

Harvesting

I don’t know about what to cook it in but how are you going to store it?

Time for ware growers to invest in dedicated seed storage?

Storage

Storage

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