



CONTRACT REPORT

Potato Blight (*Phytophthora infestans*) and Planting Density Field Demonstrations, 2005

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AUTHENTICATION

I declare that this work was done under my supervision according to the procedures described herein and that this report represents a true and accurate record of the results obtained.

..... David Frost
Study Director

Date

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INTRODUCTION

The main issue facing potato breeders is resistance to disease. Yield is an agronomic issue rather than a breeder's problem. There are, however, approximately 600 pests and diseases that affect potatoes; the most serious of these are Potato Cyst Nematode (PCN), Bacterial Wilt and Late Blight. The introduction of *Solanum Andigena* from Andean strains has resolved the PCN problem in the UK although it remains a serious problem elsewhere. Bacterial Wilt is a global problem which is now present in some areas of Europe, but not in the UK. Late Blight is an important disease facing potato growers and breeders and a major limiting factor on organic potato production in the UK.

Strategies to combat blight

As the Late Blight pathogen *Phytophthora infestans* is able to evolve and diversify, the British Potato Council acknowledges that the problems of controlling it are increasing year on year. Traditional control methods relied on copper-based fungicides such as Bordeaux mixture (copper sulphate and calcium oxide). Copper (Cu) is a broad-spectrum fungicide which acts as a protectant – it needs to be applied to prevent disease – and is potentially phytotoxic. As the use of copper as a fungicide is being withdrawn¹ and as the drive to reduce the use of agri-chemicals such as fungicides increases, alternative strategies require evaluation. These include:

- Agronomic strategies - control of volunteers, manipulation of planting dates, pre-sprouting, seed spacing, irrigation and defoliation.
- Prophylactic strategies - compost teas & herbal preparations
- Use of resistant varieties

Blight resistant varieties - The UK breeding program

The Scottish Crops Research Institute have bred 44 new varieties since 1977. 50% of these are still available for commercial production. The main cultivars with high levels of blight resistance are Lady Balfour & Stirling. These cultivars were assessed in the 2004 ADAS Farming Connect blight trials (Frost & Clarke, 2005).

Sarpo blight resistant varieties

In Hungary, Sárpo KTF has been selecting for blight resistance continually since the 1940s and has introduced new genetic material from wild Andean species. This process of selection has resulted in cultivars with a high level of horizontal resistance to foliar blight (Shaw and Johnson, 2004). The Sarpo (NB. *Sarpo* = + potato) seed used in the current trial was supplied by the Sárvári Research Trust at the University of Wales, Bangor.

Farming Connect blight resistance trials

In 2003 ADAS Wales undertook limited blight trials comparing resistance in 3 Sarpo varieties² with the commercially available cultivar, King Edward. The trial found that the Sarpo varieties out performed the untreated King Edward variety in foliar blight resistance (ADAS, 2003).

¹ The EU Blight-MOP project found that countries with a Cu ban had the lowest returns to organic potato growers

² The varieties trialed in 2003 were, 87/4/18 (Axona); 93/4/15; 84/01/104

In 2004, further trials were undertaken with 28 varieties of potatoes, including 19 Sarpo clones, to test their resistance to potato blight in a high-risk area (Frost & Clarke, 2005).

In 2005, ADAS undertook blight trials of 16 varieties, including 13 Sarpo clones. Additional trials were undertaken with the nationally listed Sarpo variety, Axona, to assess the effect of planting densities on weed suppression and yield. These trials are reported here.

Although ranking of blight resistant varieties and evaluation of compost extracts were included in the MOP project; the use of compost teas from Controlled Microbial Composting systems as a prophylactic against blight was not assessed. The microbial activity of these preparations provides a potential alternative to chemical pesticides and fungicides such as sulphur and copper (Hutchinson, 2003; Hutchinson, 2004), but to date few trials have been undertaken. A limited trial of compost tea preparations was undertaken by ADAS Wales in 2004 and further trials were undertaken in 2005. These are also reported here.

POTATO BLIGHT AND PLANTING DENSITY FIELD DEMONSTRATIONS, 2005

1. OBJECTIVES

1.1 Primary Objectives

- To examine the level of resistance to *Phytophthora infestans* in selected Sarpo potato clones in a high risk blight area
- To undertake potato variety trials, including assessment of yield, on an established certified organic holding
- To evaluate the cultivar Axona for yield potential under different seed rates

1.2 Secondary Objectives

- To evaluate the use of compost tea in the control of potato blight in Wales
- To undertake evaluations of the eating quality of varieties selected from the trials

2. TREATMENTS

2.1 Use of varieties with different levels of resistance

The National Institute for Agricultural Botany (NIAB) has developed a rating system to indicate the susceptibility of potato varieties to blight, where 9 = healthy and 1 = susceptible. According to the British Potato Council, NIAB ratings lower than 5 should only be grown for specialist markets and lower yields due to earlier defoliation should be expected. Organic growers are advised to avoid the use of varieties with ratings less than 3 (British Potato Council, 2003).

In 2005, the Research Trust supplied 13 clones of Sarpo for blight resistance trials and a further 3 commercially available varieties were included in the trial. These were Orla (a second early variety supplied by the Irish Potato Marketing Board) Cara (NIAB rating 6); and Desiree (NIAB rating 5). The full list of the potato cultivars used in the 2005 trial is given in Table 1.

For the compost tea evaluations, two varieties were used, Charlotte and Cosmos. The nationally listed cultivar Axona was evaluated in the planting density trial. The blight prone variety King Edward was planted in guide rows to spread infection throughout the site.

TABLE 1 POTATO CULTIVARS EVALUATED IN THE BLIGHT TRIALS

Number	Variety Identification Number	Variety Name
1	97-18-6	Una
2	98-2-5	Ivan
3	97-18-24	Val
4	98-34-4	Quentin
5	96-1-16A	Ginny
6	98-3-32	Jackie
7	99-65-2072	Carrie
8	98-11-2	Sally
9	96-22-1	Harri
10	99-43-819	Bob
11	98-79-1	Rob
12	2000-21-192	Dawn
13	97-10-5	Olive
14		Orla
15		Cara
16		Desiree

Note: For Sarpo varieties, red-skinned cultivars have been allocated a female name and white skinned cultivars have been allocated a male name. However Quentin is blue-skinned and Axona is red-skinned. Of the commercial varieties, Charlotte and Cosmos are white skinned, Cara and King Edward are predominantly white skinned but have red eyes.

2.2 Compost tea treatments

Compost tea was made in a microbrewer using material from a Controlled Microbial Composting system.

Treatment No	Treatment	Period of Application
1	Untreated	
2	Compost tea @ 4 days	26/06/05 to 19/08/05
3	Compost tea @8 days	21/06/05 to 19/08/05

All sprays were applied using an Oxford Precision Sprayer

Boom width	2 metres
Nozzles	Lumark F110-03
Pressure	1.5 bar
Application Rate	1 litre per plot (370 l/ha)

2.3 Seed spacing / row width treatments

Plot size	-	4 rows x 7.2 m
Treatments	-	inter row seed spacing 20 cm 25 cm 30 cm 35 cm 40 cm
	-	row width 28 ins 30 ins 32 ins
Harvest	-	Whole plots of each treatment were harvested

3. SITE DETAILS

In order to evaluate the vigour and growth of Sarpo cultivars under organic husbandry, the trial was undertaken on certified organic land. The site selected has been in continuous organic management for over 20 years and certified by the Soil Association since 1984. The site, in a 1.5 ha field surrounded by hedges, was at 120 m above sea level and 1.5 miles from the coast near Llanrhystud in West Wales. Although the land used for the trial had been down to a grass/clover ley for the previous four years and to brassicae in the year before this, potatoes have been grown on the farm since 1982. According to farm records, foliar blight is usually present in untreated potato crops by the second or third week of July. In 2005, the trials was planted on May 11-12th and blight was first seen on site on June 26th.

Full site details are given in Table 2.

TABLE 2 SITE DETAILS

SITE NAME	Llanrhystud
Soil Texture:	Sand / Silt Loam
Previous Cropping:	
2004	Grass/clover
2003	Grass/clover
2002	Grass/ clover
2001	Grass/clover
Cultivations prior to planting:	Plough, power harrow, rotovate
Planting date:	11-12 May
Harvesting date:	2 December
Fertiliser (g/sqM):	100g/Sq M organic pelleted chicken manure
Mechanical weeding	7 & 21 June
Blight seen on site	26 June
Haulm removal	Cut to ground level 16 September
Irrigation	None
Trace elements	None

FIGURE 1. WEEDING POTATOES, CULTIVAR AXONA, LLANRHYSTUD SITE, 7 JUNE 2005



FIGURE 2 TRIAL GROUND, 24TH AUGUST 2005

Blight trials are shown on the left of the photograph – King Edward spreader rows infected with foliar blight, trial plots blight-free.

Planting density trials are shown in the centre and to the right of the photograph – showing cultivar Axona, blight-free.



4. METHODS

4.1.1 Layout of variety trials for blight resistance

The cultivars were arranged in a fully randomised complete block design with three replicates. The plots were four rows wide (3.0 m) and measuring 3.3 m in length.

4.1.2 Layout of trials to assess the use of compost tea against foliar blight

The plots were arranged in a fully randomised complete block design with four replicates (2 replicates on Charlotte and 2 replicates on Cosmos). Plots were four rows wide (3.0 m) and measuring 9 m in length.

4.1.3 Layout of trial to assess effects of planting densities on weed suppression and yield using Axona

The Axona plots were arranged with all plots four rows wide and measuring 7.2 m in length.

4.2 Records of weather conditions

Weather conditions, particularly temperature and humidity, affect the spread of the airborne blight fungus. Smith Periods relate weather conditions to blight development. They are periods which are conducive to sporulation of the blight pathogen on lesions – leaf wetness is also necessary. Smith Periods are calculated by the British Potato Council's Blight Watch programme from hourly temperature and relative humidity values supplied by the meteorological office. They are interpolated to postcode areas for the whole of the UK.

A full Smith Period has occurred when there has been at least two consecutive days where the minimum temperature is 10 degrees C or above and on each day at least 11 hours when the relative humidity is 90 %.

A 'Near Miss' occurs when one or both of the two consecutive days has only 10 hours when the relative humidity is greater than 90%.

Full Smith Periods and Near Misses were recorded for the site from Blight Watch (<http://www.potatocrop.com/potatobligh.htm>).

4.3 Photographic records and written descriptions

Photographs were taken of each variety in the trial to show characteristics of growth and haulm habit.

4.4 Records of foliage blight

FIGURE 3 FOLIAR BLIGHT CULTIVAR CARA, PHOTOGRAPHED 3RD SEPTEMBER 2005



Foliage blight was assessed regularly on all three trials during the epidemic as a percentage of leaf area destroyed by blight using a modified MAFF key 2.1.1 - Potato Blight on the Haulm (Anon., 1947 & 1976 ; Large, 1952), see Table 3.

TABLE 3 KEY FOR ASSESSING FOLIAR BLIGHT

Blight %		Description
0		Not seen
0.1	1+	Lesion per plot)
0.2	25	Lesions per plot)
0.3	50	Lesions per plot)
0.4	75	Lesions per plot)
0.5	100	Lesions per plot or 1 lesion per plant) Assuming
0.6		2 lesions per plant) 100 plants
0.7		4 lesions per plant) per plot
0.8		6 lesions per plant)
0.9		8 lesions per plant)
1.0		10 lesions per plant)
5.0	1	Lesion per compound leaf or 50 lesions per plant)
10.0	2	Lesions per compound leaf or 100 lesions per plant)
25.0		Nearly every leaflet with blight lesions - plants still retaining their normal form - 75% plot leaf area remaining green
50.0		About half of the leaf area destroyed by blight
75.0		About three-quarters of the leaf area destroyed by blight
95.0		Stems green, only a few leaves remaining
100.0		All leaves dead, stems dead or dying

After Anon, 1947

4.5 Assessment of yield

All Sarpo trials plots were harvested. Plot yields were taken using an elevator potato harvester and manually forking each plot, All tubers >35 mm were included in the yield totals excluding rotted tubers. Yields were calculated as tonnes per hectare. Due to a mechanical breakdown and a deterioration in ground conditions, yields were unable to be taken from the compost tea plots.

4.6 Destruction of haulm

The haulm was manually cut to ground level and removed from each plot on 16 September.

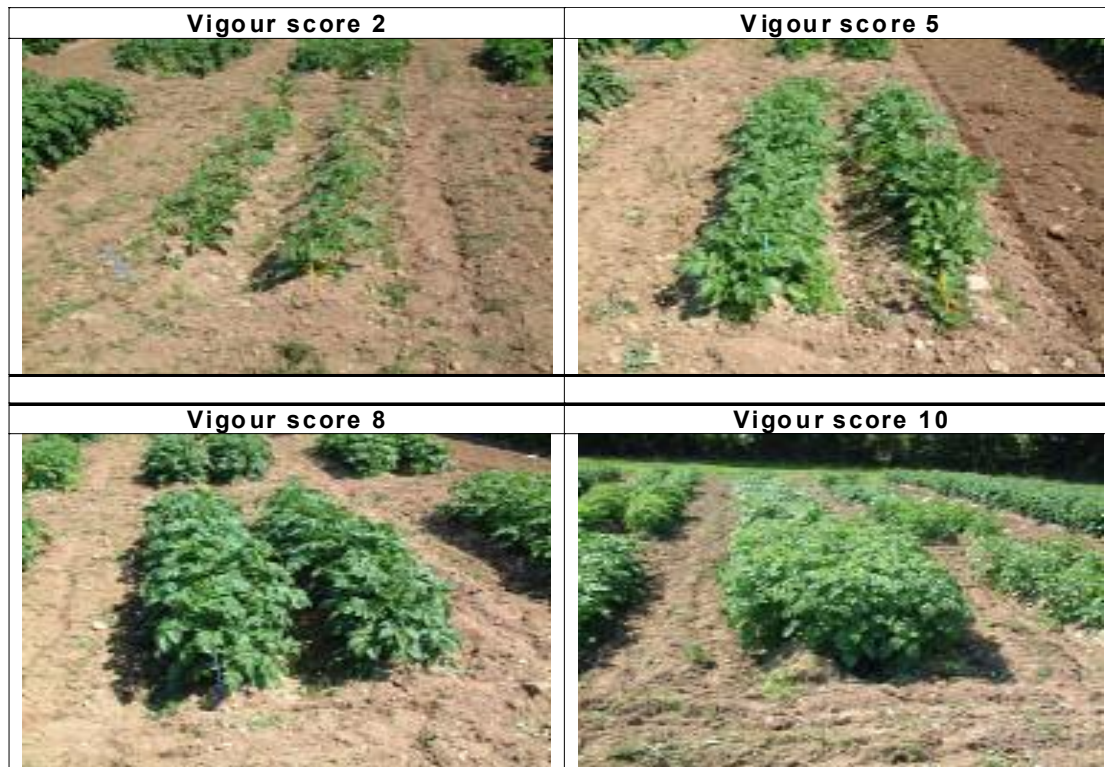
4.7 Assessment of canopy height

Canopy heights were taken from the centre of each plot using a graduated measuring stick.

4.8 Assessment of canopy vigour

Canopy vigour scores were taken by assessing the canopy cover over the whole plot whilst looking down the centre of each plot individually. With total bare ground scoring 0 and no bare ground seen scoring 10.

FIGURE 4 ASSESSMENT OF CANOPY VIGOUR



4.9 Foliar blight - Statistical Analysis

The progress of the foliar blight epidemic for each of the treatments was represented by a sigmoidal disease progress curve. The intensity of blight infection was measured for each plot by calculation of the **Area Under the Disease Progress Curve (AUDPC)** using numerical integration. AUDPC is expressed as units of 'percentage.days'.

AUDPC and yield data for all treatments were subjected to an Analysis of Variance in order to obtain the standard error of the difference (SED) which was used to assess the significance of differences.

4.10 Assessment of tuber blight

Post harvest assessments of the presence and extent of tuber blight were made for each replicate in the trial. The number of tubers affected by blight was recorded as a percentage of the total number of tubers; and the weight of tubers affected was also recorded as a percentage of the total weight of tubers.

4.11 Evaluations of the eating quality of varieties selected from the trials

Samples of potatoes from six varieties in the blight trials were taste-trialed by visitors at the open day, by members of the CALU Steering Group and by staff at ADAS Pwllpeiran. The varieties taste-tested were Axona, Sarpo Bob, Sarpo Quentin, Sarpo Dawn, Sarpo Una and the control variety, King Edward.

Participating taste-testers were asked to record their evaluations on a standard sheet (a modified version of one supplied by the Savari Research Trust). Assessments recorded were: flavour, texture, defects, acceptability and comparison with usual and favourite varieties.

None of the taste-tests were undertaken as blind or double-blind tests.

5. RESULTS

5.1 The blight epidemic 2005

5.1.1 Smith Periods

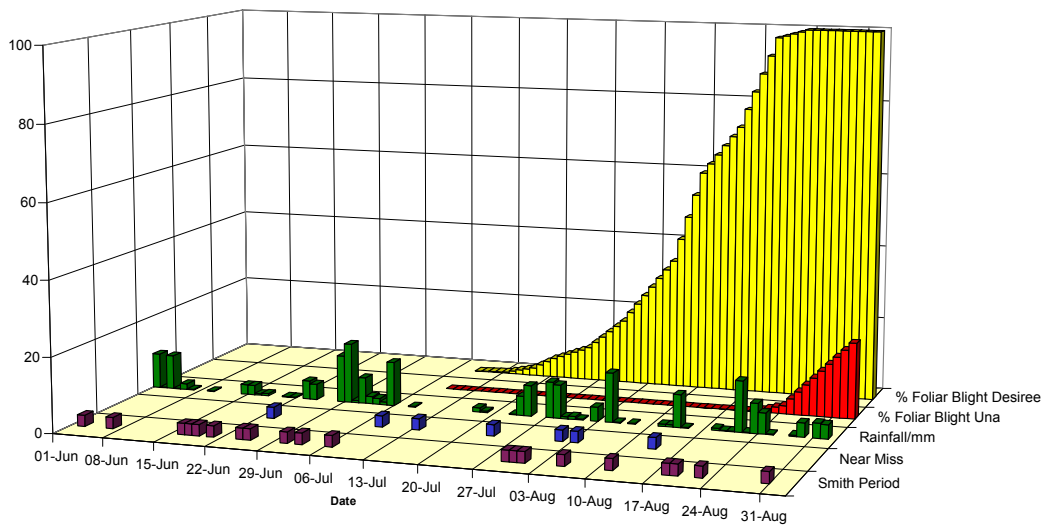
When Smith Periods occur at frequent and regular intervals (7-10 days) in combination with rainfall, there is greater chance of blight development.

Rainfall data recorded at Trawscoed and Smith Periods recorded at Llanrhystud together with foliar blight progress on King Edward plots in the trial are given in Figure 4.

FIGURE 5 RAINFALL, SMITH PERIODS AND BLIGHT PROGRESS IN DESIREE & UNA PLOTS

The chart shows the rapid progress of foliar blight in the Desiree and Una crops during the combination of Smith Periods and rainfall in August 2005.

Daily rainfall as recorded at Trawscoed, Smith Periods as recorded for Llanrhystud by Blight Watch, and blight progress 2005.



5.1.2 Foliage blight infestation & AUDPC analysis

Foliar blight infection was first recorded on King Edward plants in the spreader rows on 26th June 2005. The AUDPC analysis is presented in Table 4

TABLE 4 AUDPC (AREA UNDER DISEASE PROGRESS CURVE)

Variety	AUDPC
Una	106 e
Ivan	171 e
Val	1 e
Quentin	857 cd
Ginny	12 e
Jackie	4 e
Carrie	0 e
Sally	2 e
Harri	597 de
Bob	114 e
Rob	0 e
Dawn	1219 c
Olive	16 e
Orla	3328 a
Cara	1294 c
Desiree	2547 b
LSD (P=.05)	382.8
CV	35.78
Treatment Prob(F)	0.0001

AUDPC analysis shows that foliar blight developed most rapidly on cultivar Orla, followed by Desiree. Cara was comparable with the Sarpo variety Dawn. Sarpo varieties Quentin and Harri were slightly susceptible to foliar blight, while Carrie and Rob were unaffected by foliar blight.

5.1.3 Foliage blight on compost tea treatment plots

As can be seen from Table 5, there was little difference in disease progression between treated and untreated plots. Although the progression of foliar blight in the untreated plots compared to the two treatment plots was slightly more advanced during July this was not maintained during August. Furthermore, when subject to Analysis of Variance, the differences were not found to be significant.

Table 6 compares the progression of foliar blight in the two varieties in the compost tea trial. The progression was more rapid in cultivar Charlotte than in Cosmos, but when subject to Analysis of Variance the differences were not found to be significant except for one assessment undertaken on 30 July 2005.

TABLE 5 MEAN PERCENTAGE FOLIAR BLIGHT ON COMPOST TEA TREATMENTS

Treatment	02-Jul	09-Jul	13-Jul	17-Jul	20-Jul	25-Jul	30-Jul	06-Aug	10-Aug	15-Aug	20-Aug
Untreated	0.03	0.00	0.45	4.03	8.10	21.38	25.13	33.75	52.50	72.50	95.00
Compost Tea@ 4 day	0.03	0.08	0.40	3.05	7.83	17.58	32.58	36.25	48.75	63.75	93.75
Compost Tea@ 8 day	0.00	0.28	0.28	3.03	7.58	20.08	30.08	37.25	53.75	67.25	95.00

When subject to Analysis of Variance these findings were found not to be statistically significant.

TABLE 6 MEAN PERCENTAGE FOLIAR BLIGHT ON COMPOST TEA VARIETIES

Treatment	02-Jul	09-Jul	13-Jul	17-Jul	20-Jul	25-Jul	30-Jul	06-Aug	10-Aug	15-Aug	20-Aug
Charlotte	0.03	0.22	0.73	6.67	15.50	39.17	58.33	69.17	89.17	98.17	100.00
Cosmos	0.00	0.02	0.02	0.07	0.17	0.18	0.18	2.33	14.17	37.50	89.17

When subject to Analysis of Variance these findings were found not to be statistically significant. Differences were found on 30 Jul assessment only.

5.1.4 Foliage blight on Seed spacing/Row width

No foliar blight was found on the Axona plots In this trial.

5.2 Yield of clones in the blight resistance trials

Highest yields in this trial were recorded for the Sarpo varieties Una (62.25 t/ha), Val (58.91 t/ha) and Ginny (52.17 t/ha). Sarpo varieties that had some blight susceptibility – Quentin (31.33.t/ha) and Harri (47.07 t/ha) recorded yields near the median of the distribution, while the cultivar Rob (18.93 t/ha) which had no blight susceptibility had the lowest yield in the trial. The low yield of this cultivar is related to its lack of vigour and susceptibility to weed competition (see Table 7). Yields of the commercially available cultivars Desiree (27.37 t/ha), Cara (26.32 t/ha) and Orla (23.93 t/ha) were lower than all of the Sarpo varieties except Rob.

The total yields for each cultivar in the trial are given in Table 7.

TABLE 7 TOTAL YIELDS OF TUBER >35 MM FOR EACH CULTIVAR IN BLIGHT TRIALS, 2005

Treatment (Variety)	Mean Yield t/ha *
Una	62.25 a
Ivan	21.10 ef
Val	58.91 ab
Quentin	31.33 def
Ginny	52.17 abc
Jackie	45.78 bcd
Carrie	33.60 def
Sally	37.16 cde
Harri	47.05 bcd
Bob	37.06 cde
Rob	18.93 f
Dawn	34.56 def
Olive	44.07 cd
Orla	23.93 ef
Cara	26.32 ef
Desiree	27.37
LSD (P=.05)	10.2
CV	16.27
Treatment Prob(F)	0.0001

* Treatment means followed by different letters are significantly different (P<0.05) according to Duncan's Multiple Range Test. Means with the same letter are not significantly different

5. 3 Growth vigour and canopy height

Mean vigour scores were highest for Sarpo Ginny (8.7) followed by Sarpo Quentin (8.0), Sarpo Una (8.0) and Sarpo Val (8.0). Mean vigour scores were lowest for Sarpo Ivan (2.7), Sarpo Rob (3.3), Sarpo Carrie (4.0) and Sarpo Sally (4.7). Commercial varieties Desiree (7.0), Cara (7.3) and Orla (7.3) had vigour scores above the median in the distribution

Canopy heights are evaluated as these are an indicator of the ability of each clone to out-compete weeds. Canopy heights in the trial showed considerable variation. The Sarpo variety Quentin (90 cm) had the highest canopy, followed by Sarpo Val (85cm). The varieties with the lowest canopies were Sarpo Ivan (50cm) and Sarpo Rob (55cm). Commercial varieties Desiree (76.7) and Orla (76.7cm) were near the median of the distribution with Cara (83.3cm) among the varieties with the highest canopy.

TABLE 8 VIGOUR SCORES AND HEIGHT

Variety	Mean Vigour score	Mean Height (cm)
Ivan	2.7	50.0
Rob	3.3	55.0
Carrie	4.0	56.7
Sally	4.7	66.7
Olive	6.3	71.7
Bob	7.0	76.7
Desiree	7.0	76.7
Cara	7.3	83.3
Dawn	7.3	76.7
Jackie	7.3	78.3
Orla	7.3	76.7
Harri	7.7	80.0
Quentin	8.0	90.0
Una	8.0	75.0
Val	8.0	85.0
Ginny	8.7	81.7

5.4 Post harvest evaluation for tuber blight

Assessments of cultivars post-harvest found the highest incidence of tuber blight in Sarpo Olive (22% of tubers blighted by number; 19% of tubers blighted by weight), followed by Sarpo Sally (13% of tubers blighted by number; 17% of tubers blighted by weight), and Sarpo Carrie (11% of tubers blighted by number; 15% of tubers blighted by weight). Post-harvest tuber blight was evident at low levels in Sarpo cultivars Ivan, Val, Bob, Rob and Harri but not found in Desiree, Cara or Orla.

TABLE 9 PERCENTAGE TUBER BLIGHT FOR EACH VARIETY

Treatment (Variety)	Mean % Tuber blight by number	Mean % Tuber blight by weight (kg)
Una	0 d	0 b
Ivan	5 cd	5 b
Val	3 d	2 b
Quentin	0 d	0 b
Ginny	0 d	0 b
Jackie	0 d	0 b
Carrie	11 bc	15 a
Sally	13 b	17 a
Harri	1 d	1 b
Bob	5 cd	4 b
Rob	2 d	2 b
Dawn	0 d	0 b
Olive	22 a	19 a
Orla	0 d	0 b
Cara	0 d	0 b
Desiree	0 d	0 b
LSD (P=.05)	5.6	7.7
CV	89.22	115.54
Treatment Prob(F)	0.0001	0.0001

* Treatment means followed by different letters are significantly different (P<0.05) according to Duncan's Multiple Range Test. Means with the same letter are not significantly different.

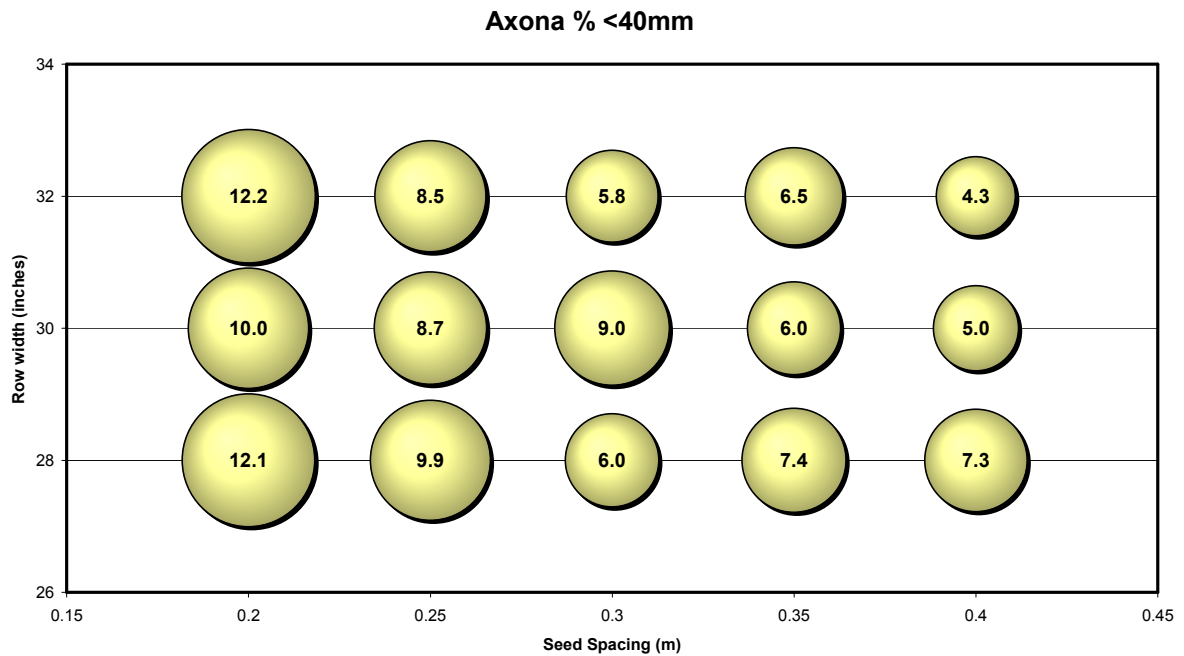
6. Effects of planting densities on yield – cultivar Axona

Total yield of the variety Axona showed no obvious trend over the range of planting densities. The lowest total yield (29.5 t/ha) for all sizes of tubers was recorded at 40cm seed spacing on row widths of 81cm (32 inches). Highest total yield (39.5 t/ha) for all sizes of tubers was recorded at 25cm seed spacing on row widths of 71cm (28 inches).

When yield data is analysed by tuber size however, more definite trends become apparent - as shown in the accompanying figures.

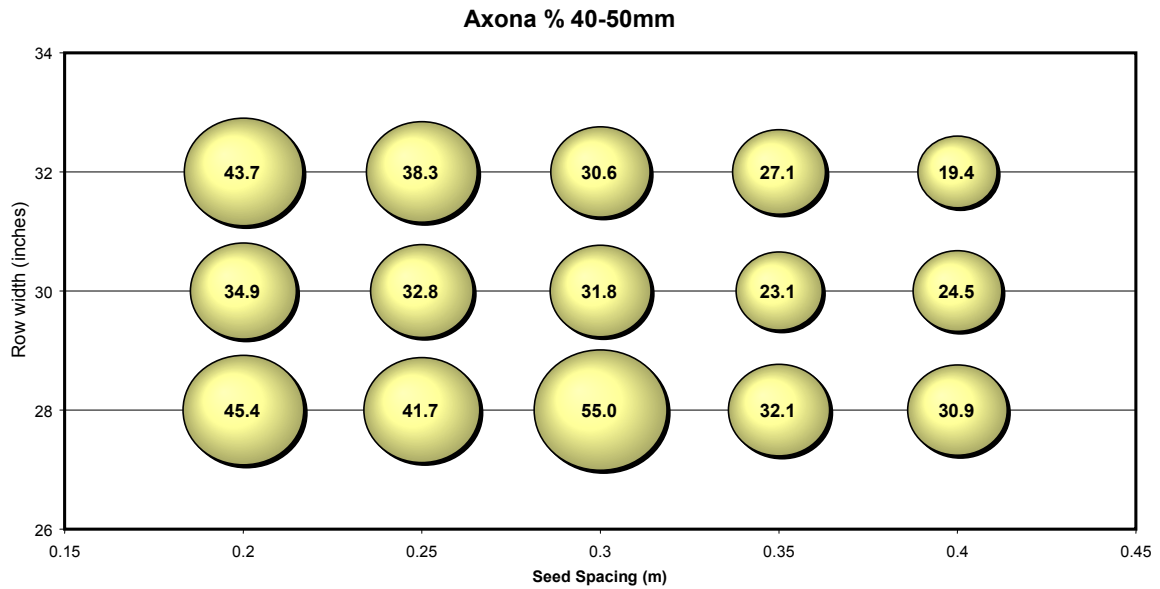
The highest yield (12.2 t/ha) of the smallest sized tubers < 40 mm, chats or mids, was recorded at the closest seed spacings, 20cm at row width 81cm (32 inches).

FIGURE 6. PERCENTAGE YIELD OF AXONA < 40MM AT DIFFERENT PLANTING DENSITIES



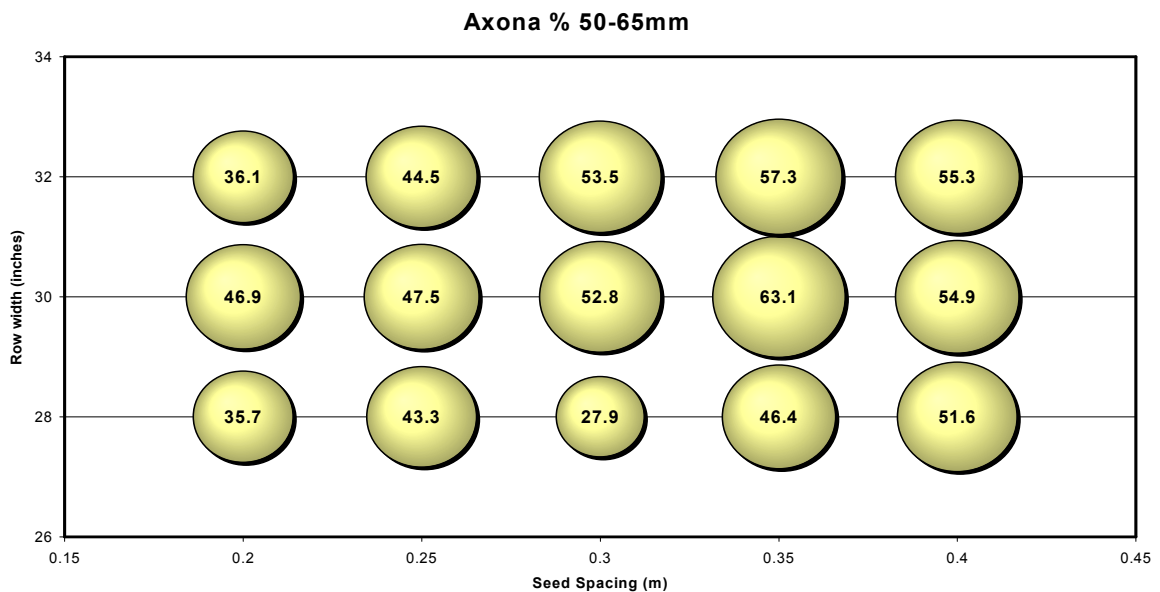
The highest yield (66 t/ha) of tubers in the size range 40-50mm (suitable for seed potato production or for salad potatoes) was recorded at seed spacing 30cm at row width 71cm (28 inches).

FIGURE 7. PERCENTAGE YIELD OF AXONA 40 - 50 MM AT DIFFERENT PLANTING DENSITIES



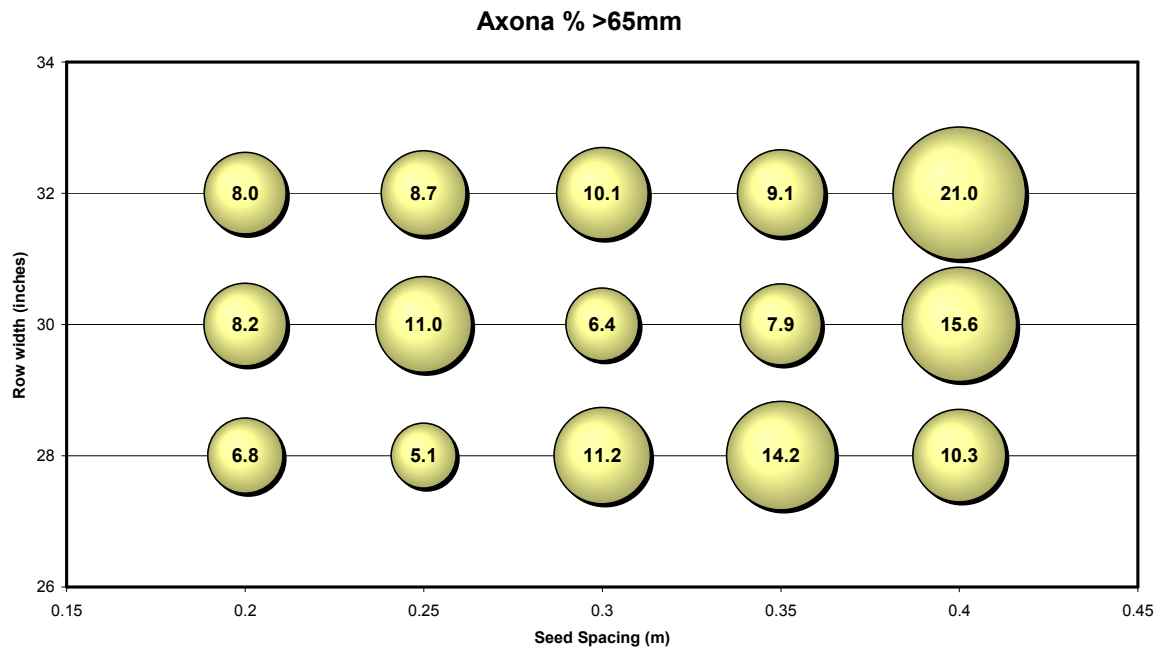
The highest yield (63.1 t/ha) for tubers in the range 50-65 mm, suitable for ware table potatoes, was recorded at 35cm seed spacing and 76cm (30 inches) row width.

FIGURE 8. PERCENTAGE YIELD OF AXONA 50 –65 MM AT DIFFERENT PLANTING DENSITIES



For the largest tubers > 65 mm, suitable for bakers or for processing, the highest yield (21 t/ha) was at 40cm seed spacing at 81 cm (32 inches) row width.

FIGURE 9. PERCENTAGE YIELD OF AXONA > 65 MM AT DIFFERENT PLANTING DENSITIES



8. Evaluations of eating quality of selected varieties

Three of five Sarpo cultivars harvested from the trials were found to be acceptable to taste-testers. The majority of those who tested Axona (6 out of 13), Sarpo Bob (8 out of 16) and Sarpo Quentin (11 out of 17) said they would buy them in a supermarket or in a box scheme. One of 2 taste-testers said they would buy Una and 1 of 2 taste-testers said 'maybe' to buying Dawn.

Sarpo Quentin, Sarpo Bob and Sarpo Dawn received the most positive scores for taste. Axona and Sarpo Dawn were assessed as mild.

Most taste-testers found Axona, Sarpo Quentin and Sarpo Bob to have a dry-mealy texture, though there was a much greater range of opinion in the case of Sarpo Quentin and Sarpo Bob than for Axona. Opinion as to the texture of Sarpo Una and Sarpo Dawn was divided.

None of the varieties received high scores for defects, though scab and hollow-heart were recorded for Axona and some taste-testers noted disintegration on boiling and discolouration after cooking for each of the varieties. No defects were mentioned by the 4 taste-testers that assessed the control cultivar, King Edward.

Taste-testers were also asked to record their comments and to compare the trial varieties with their usual or favourite potato.

Axona was found to be 'acceptable' and 'inoffensive' and a 'good chip variety'. One taste-taster said Axona was very 'very nice compared to Desiree' but another said it was 'not as tasty as Desiree'.

Sarpo Bob was praised for its 'good appearance and colour', its 'unique lovely flavour' and its 'great texture'. It was described as 'delicious', 'very tasty indeed', 'lovely – nice and tasty both as chips and baked', 'the best yet'. These positive responses were not unanimous. Other tasters said Sarpo Bob was, 'not as good as Axona' and 'not as good as Desiree'. One taste-taster found Sarpo Bob to have a 'bitter green flavour' – though this may be attributable to greened tubers – a agronomic problem caused by exposure to sunlight.

Sarpo Quentin was described as a 'very white fleshed potato' which was 'very nice indeed'. It was 'good fried' and 'very tasty chipped and fried'. Sarpo Quentin 'baked very good too'. Compared to other varieties it was 'better than Bob as chips', 'more tasty than Cara', 'drier than our usual bakers – Estima'. Compared to taste-testers' usual varieties it was, 'almost as good!', 'acceptable' and 'on a par', however one taste-taster said Quentin was 'not as tasty as Desiree'.

Only two comments each were recorded for Una and Dawn. Una was 'acceptable' and 'not good'. Dawn was 'not as nice as Desiree' and 'not my first choice'.

Only one comment was recorded for King Edward, 'the best still!'

TABLE 10 ASSESSMENT OF FLAVOUR, TEXTURE AND QUALITY OF SELECTED CULTIVARS

	Axona	Bob	Quentin	Una	Dawn	King Edward
Flavour <ul style="list-style-type: none"> • tasteless • mild • pronounced • earthy • off-flavour • other 	2 8	7 4 1	7 2 4 2	2 2 1	2	2 2
Texture <ul style="list-style-type: none"> • wet • waxy • sticky • dry-mealy • other 	9 1	2 3 9	2 3 3 8	2 1 1	1 1	2 1 1
Defects <ul style="list-style-type: none"> • damaged • pest • diseased • greening • hollow heart • other 	1 1 (scab)		1			
Defects <ul style="list-style-type: none"> • disintegration on boiling • discoloration after cooking • other 	2 3 1	2 1	2 2	2 3	1 1	
Acceptability would you buy this potato in the supermarket or in an organic box? <ul style="list-style-type: none"> • Yes • No • maybe 	6 1 2	8 1 1	11 1 1	1 3	1	3
Total tasting the variety	13	16	17	12	2	4

CONCLUSIONS

The trials undertaken in 2005 found that Sarpo cultivars showed high foliar blight resistance with the exception of Sarpo Dawn, Sarpo Harri and Sarpo Quentin. Blight resistance in Sarpo cultivars was greater than in commercially available varieties in the trial with the exception of Sarpo Dawn. Sarpo Dawn showed no significantly higher degree of blight resistance than the highest scoring commercial cultivar, Cara.

Post-harvest tuber blight was recorded in 5 of the Sarpo varieties, but in none of the commercial varieties. The highest incidence of tuber blight was found in Sarpo Olive, followed by Sarpo Sally and Sarpo Carrie.

There was a considerable range in yield between cultivars, with a range from 19 t/ha to 62 t/ha. With one exception (Sarpo Rob), all the Sarpo varieties had higher yields than the commercially available varieties.

Compost tea treatments did not significantly delay the onset of foliar blight on either of the varieties in the trial. This experiment was a major blight challenge to the treatments because as the epidemic progressed the site became heavily infected. Overall, there was no statistically significant prophylactic effect of the compost tea treatments.

Planting densities had an effect on the yield of different sized tubers. Closer seed spacing and row widths produced higher yields of small sized tubers, whereas wider seed spacing and row widths produced higher yields of large sized tubers. Overall total yields appeared to show no direct correlation with planting density.

Taste-testing trials found a generally positive response to Sarpo varieties, with the majority of testers saying they would buy them. Responses to taste and texture were also positive, especially for Sarpo Bob and Sarpo Quentin. Some defects (skin finish, hollow heart, disintegration) were noted that could affect marketability, especially for Axona.

RECOMMENDATIONS

This trial has produced information which will be of value to potato growers. It also leads to the following recommendations:

1. There should be a continuation of potato blight trials with further Sarpo clones compared with standard varieties in order to assess their suitability for cultivation in high-blight risk areas.
2. Evaluations should be undertaken of Sarpo clones selected from the 2004 and 2005 trials for vigour of growth and ability to suppress weed competition (as measured by canopy height) as well as resistance to potato blight. These characteristics are particularly valuable for organic growers.

3. Evaluations should be undertaken of sequential harvesting trials to determine the relationship between yield and skin finish / tuber defects as affected by timing of harvest.
4. Evaluations of the eating quality of blight resistant varieties should be undertaken at the Welsh Food Centre using trained taste testers and under controlled conditions. To be commercially successful, potato varieties need to have consumer acceptance and produce an economically viable yield.

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APPENDIX

CONTROLLED MICROBIAL COMPOSTING AND COMPOST TEAS

COMPOSTING MATERIALS

6 x 50m windrows made up in horizontal layers with:

- 1/3 FYM
- 1/3 brown material (woodchip / spoiled hay etc)
- 1/3 green material (vegetable waste / weeding / cut grass-clover)
- small portion loam or clay

ESSENTIAL EQUIPMENT

- compost turner
- tractor with creep gear
- crop covers
- monitoring equipment
- starter mix

COMPOST TURNER

- windrows, mixes and aerates the pile
- operates like an Archimedes screw
- promotes biological activity

COVERS

- Top Tex
- geotextile fabric
- gas permeable
- repel water
- cost £200 sheet
- cheaper than erecting a building
- applied using fleece roller on the compost turner

MONITORING EQUIPMENT

- thermometer with lance
- instrument for measuring and reading CO₂ levels

COMPOST TEAS

- microbrewer makes a tea multiplying organisms from the original compost
- used as a drench on transplants to protect against infection (eg *rhizoctonia*, mildew in lettuce) and on crops as foliar spray
- soil drench
- promising method of controlling fungal diseases but more work needed