



Sarpo Potatoes Ltd.

Seed Production Manual, First Edition

Spring 2017



An introduction to the requirements for growing Sarpo seed potatoes in Wales



Foreword

Growing seed potatoes for Sarpo Potatoes Ltd (SPL) provides an opportunity for growers of all sizes who are looking to diversify into a high value and expanding market. SPL has recently won funding through the Rural Development Plan for Wales 2014 – 2020 for the 'Sustainable Potatoes Wales' (SPW) project, of which the production of this manual is a part. SPL gratefully acknowledges this support.

The project has three aims:

- To expand SPL's seed grower base
- To streamline its grading, packing and storage operations
- To grow the market for Sarpo potato varieties (seed and ware) in Wales

Although there are many statutory and agronomic considerations to producing a crop of seed, many of the basic principles are the same as growing ware (eating) potatoes. This manual will hopefully provide guidance to the experienced and novice seed potato producer alike. The statutory requirements discussed have been primarily sourced from The Explanatory Guide to the Seed Potato Classification Scheme and the Approved Stock Scheme for the 2016/17 Growing Season, published by the Animal and Plant Health Authority (APHA). (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/523572/SPCS-guide.pdf). Content specifically relating to Sarpo varieties is based upon our own experiences, both good and bad, of growing Sarpo seed potatoes throughout England and Wales in the past ten years.

We have tried to make this manual as useful and comprehensive as possible but, as with any guide of this nature, it is general and not site-specific. So while the statutory requirements will remain the same for all growers, the agronomic advice may vary from site to site. SPL staff will always be on hand to discuss this. The manual comprises of a general introduction and then divides roughly into two sections, one covering the whole growing season, from site selection to storage and grading and the other covering the certification process itself. While there is naturally some overlap between these sections we hope this will make for a user-friendly, easy-to-refer-to document.

There is a demand for certified seed, both organic and conventional, and we have made the manual relevant to both production systems.

Thank you for your interest in producing seed potatoes for us, and we wish you every success for the coming season.

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1. General Introduction

1.1 What are Sarpo potatoes?

Sarpo (a contraction of *Sarvari* and *potato*) potatoes are a range of potato varieties that were bred by the Sarvari family in Hungary and subsequently trialled and developed by the Sarvari Research Trust in North Wales. The Sarvari breeding programme was focused on producing varieties with high resistance to common virus diseases as well as to late blight.

There are currently seven Sarpo varieties on the UK National List: Sarpo Mira, Sarpo Axona, Sarpo Shona, Sarpo Una, Kifli, Blue Danube and Sarpo Gwyn. A variety must be on the UK National List or the EU Common Catalogue for it to be grown and sold commercially. Some of these varieties are in very short supply but all should be available to grow as seed within the next 2-3 years. Detailed descriptions of them all can be found on the British Potato Variety Database (<http://varieties.ahdb.org.uk/>) and a summary of their important characteristics and identifying features can be found in the Appendix.

1.2 What are seed potatoes?

Seed potatoes are not just small potatoes! Seed crops are grown to particular standards of varietal purity and freedom from disease as specified by the government Seed Potato Scheme run by the Animal and Plant Health Agency (APHA) of DEFRA. Seed crops must pass these standards if they are to be certified as seed. Standards will be discussed in detail later but most are reasonably straightforward. Remember that we can advise you at all stages of the growing crop if you want. Growing seed potatoes *is* more challenging than growing a ware crop but the benefits of the contract you will be offered by SPL combined with the relative ease of growing Sarpo varieties makes Sarpo seed growing an attractive prospect.

1.3 Why grow Sarpo seed potatoes for Sarpo Potatoes Ltd?

Sarpo Potatoes Ltd (SPL) was set up in 2013 to commercialise and market Sarpo potatoes on behalf of Sarvari Research Trust (SRT). Market research had shown that the small amount of production being managed by SRT was not going to be sufficient to supply the increasing demand within the UK and developing export markets. Accordingly, we are recruiting new growers to expand our grower base and increase production.

New growers will be offered a guaranteed “buy-back” contract whereby SPL agrees to purchase all certified stocks of seed size between 35 and 55mm(graded at 35/55mm) from the grower at a price agreed before planting. This guarantees the grower a price and removes any potential fluctuations caused by market volatility during the growing season. Contract prices may vary slightly dependent on variety and grade of seed produced but Gross Margins in the region of £760 – £1255/hectare can be expected depending on yield and growing costs (source: The Organic Farm Management Handbook, 2017).

In addition to the financial benefits of growing Sarpo seed potatoes, their relative ease of cultivation makes them much less risky than the growing of other varieties. The high levels of

virus resistance in all Sarpo varieties greatly reduces the risk of crops failing certification because too many plants showed virus disease at inspection (see the section on “Field Inspections”). Also, their dense, weed smothering foliage helps maximise yield. However, it is the resistance to late blight, caused by the pathogen, *Phytophthora infestans*, that many Sarpo varieties possess that makes them ideally suited for smaller scale or organic growing and will reduce growing costs for larger conventional growers as well.

The majority of potato crops in the UK are routinely sprayed with synthetic fungicides to control blight, often up to 20 times per season. We have successfully grown Sarpo Mira and Axona as seed in Wales using only two fungicide applications even in years of high blight pressure. This represents a significant saving in terms of the fungicide itself but also in fuel use, compaction of the soil and, perhaps most importantly, the growers’ time or contractor costs.



The picture above shows two plots from an SRT blight trial in 2009. In the foreground is a once resistant, but now susceptible, variety, Sante. In the background is the Sarpo variety Axona, still green and growing strongly. No fungicide was used on either plot!

2. Growing the crop

2.1. Site selection and pre-planting

The ideal site should be flat or gently sloping, but not so steep that spraying or harvesting equipment will struggle. Never select a field that may be prone to waterlogging or too wet to harvest in the autumn. Finally, seed potatoes can only be grown on land that has not held a potato crop of any kind (not just another seed crop) for at least four years, and up to seven years depending on the quality of seed you are going to produce. If possible, give seed potatoes the best land you can spare them as the improvements in yield and quality will be worth it!

Before progressing further the selected land needs to be sampled by Plant Health inspectors who send soil samples for laboratory testing to find out if they contain the cysts (eggs) of the potato cyst nematode (PCN). These cysts survive in the soil for many years after an infested crop is harvested and would be spread to other farms through the seed. Also known as eelworm, PCN refers to two species, *Globodera rostochiensis* and *Globodera pallida*. PCN infestation retards growth and leads to early senescence of crops as the nematodes multiply and feed on the fine roots of the potato plants. Cysts attached to the roots are shown in the picture below but are barely visible to the naked eye.



If land is found to contain viable cysts, it will be declared unfit for the production of seed potatoes (including farm saved seed). Ware crops can only be grown on the land if the grower undertakes a monitored programme to reduce PCN numbers. Plant Health will schedule infested land to indicate the presence of PCN. It is particularly important to bear this in mind

if you are renting land for your seed potato production as this scheduling will obviously affect the landowner for a considerable time.

We suggest that you also have the soil analysed for levels of nutrients so that deficiencies can be corrected. A standard analysis will be primarily for N, P and K but is also for important trace elements. Potatoes need good levels of boron and calcium to help prevent them going hollow as they grow. The results of these tests will tell you how much fertiliser/manure you need to add before planting. Additionally, an acidic soil of pH around 5.5 – 6.5 is ideal as this will help prevent common scab infection.

2.2 Soil preparation

Once the site has been selected and has been found to be free from PCN (testing usually takes 7-10 days from the date of sampling) it has to be prepared for planting. Specific advice should be sought from SPL staff but in general the following steps should be taken.

Weeds, particularly perennial weeds such as docks or thistles, should be treated. These not only compete with the growing crop but interfere with harvesting. Couch grass can grow into the developing tubers and cause large numbers of rejects at grading. These weeds can either be controlled chemically using glyphosate or by deep tilling or using stale seed beds in organic systems. The field should then be ploughed and power harrowed to give as much depth as possible while being careful not to disturb and incorporate the subsoil.

Nutrients, either in the form of blended synthetic fertiliser or manures, should be applied to bring the results from the previously discussed soil analyses into line with the recommendations found in the RB209 Fertiliser Manual. Seed potatoes generally need less nitrogen than ware crops and in the case of many Sarpo varieties, excessive nitrogen can lead to too much top growth being produced at the expense of tuber development. A future edition of this Manual will contain more detail of the exact nitrogen requirements for each Sarpo variety but these data are not currently available.

Ideally, the field should be formed into beds using a deep-ridging plough) and de-stoner. This provides a depth of good, friable soil for the plants to grow in and removing stones reduces damage to the tubers at harvest. Bed forming and de-stoning should occur immediately before planting so the beds don't settle too much or get compacted due to rain, but this may not always be possible if the necessary machinery is difficult to source. Our project will promote machinery sharing to help growers with access to this specialised machinery. In areas of high autumn rainfall, growing in beds may not be ideal as beds do not dry out as readily as ridges on the flat. Again, SPL field officers can advise on this once sites have been selected.

2.3 Planting

As Sarpo varieties have long dormancy, it is often useful to chit the seed by laying it out on trays in cool shed with daylight to keep the sprouts compact. When planted, chitted seed gets off to a rapid start and plants will quickly form a dense canopy and suppress weeds.

Seed potatoes are planted more densely than ware crops, usually 20 – 25cm (8-10”) apart in rows 75cm (30”) apart. This produces a dense canopy that helps to suppress weeds. Your planter must be adjusted to give this spacing; if not, then you will grow too many oversized tubers that cannot be used as seed. It cannot be stressed enough that time spent getting your planting right is time very well spent! Exact spacing will also depend upon the size of the seed you are planting but the table below gives the spacings we would recommend when planting 35/55mm tubers.

Variety	Maturity	Spacing (inches)
Sarpo Mira	Maincrop	9 – 10
Axona	Maincrop	9 – 10
Blue Danube	Early Maincrop	8 – 9
Kifli	Early Maincrop	8 – 9
Sarpo Shona	Early Maincrop	8 – 9
Sarpo Una	2 nd Early/Early Maincrop	8
Sarpo Gwyn	Early Maincrop	8 - 9

Once the crop is planted, and before the first plants have started to show, conventional growers should apply pre-emergence herbicide. We have used various combinations of products containing prosulfocarb, linuron and metribuzin and advice on these can be tailored to individual growers needs and the most common weed species occurring in the field. The purpose of these products is to control annual weeds until the potato plants have produced a sufficiently weed smothering canopy. Organic producers may have to mechanically weed the rows until the canopy is complete depending on the weed pressure in the field.

2.4 The growing season

Once the crop has emerged it will need to be checked regularly so that any potential problems can be identified and tackled before they become too serious. If the plants are slow to emerge and/or the pre-emergence herbicide has not been completely effective then mechanical or even hand weeding will have to be undertaken. Plants should be inspected for any signs of blight infection and conventional growers should apply a systemic fungicide (eg Infinito) once there is sufficient leaf area showing and before any infection occurs. For the varieties Sarpo

Mira and Axona this is often the only fungicide application that is needed until foliage is destroyed at the end of growth. For the less resistant varieties like Blue Danube and Kifli, spraying should take place approximately every ten days once blight has been reported in the area but this will depend upon the disease pressure locally. Growers are encouraged to monitor the blight pressure in their area by registering with Blightwatch (www.blightwatch.co.uk), a free service provided by AHDB Potatoes, and tailor their spray programmes accordingly.

Test digs to determine the size of the crop should be started around the time of flowering. At this stage the tubers will still be very small but these tests will give an indication of the tuber number per plant which is important in a seed crop. Weekly random samples of plants from all parts of the field give the best indication of when most tubers are in the 35 – 55mm range. Foliage should then be removed. This can be difficult as Sarpo varieties are very vigorous and do not ripen off (senesce) naturally; hence the warning not to use too much nitrogen on the crop. The most effective way to stop a crop of Sarpo seed potatoes is known as the “flail and spray” technique which combines mechanically removing the haulms and then spraying with a chemical desiccant such as Reglone (diquat) or Harvest (glufosinate ammonium). A standard grass topper set to 15 – 20cm (6-8”) above soil level works well but care must be taken to ensure that the stems are flicked into the wheelings and not left on top of the stumps. It is important not to set the topper too low as this can result in plants being ripped out of the ground. You should be left with a shattered stump which will absorb the desiccant very effectively. Our advice, if using either of the products previously mentioned, would be to use 50-70% of the total allowed rate initially (eg 3l/hectare for Reglone) which would allow for a second spraying, should there be any regrowth. If there was some blight in the growing crop you should add a fungicide that stops tuber blight infection. We have used Shirlan (fluazinam) at 2l/hectare and this has worked well.

Organic growers will need to top the crop as described above and then use a propane burner to burn the stumps. This can be prohibitively expensive if no appropriate equipment or contractors are available locally. An alternative to propane is to keep on topping the plants if they re-grow. This more gradual destruction may delay harvest and make lifting more difficult.

2.5 Harvest, storage and grading

After the crop has been successfully stopped the tubers need to remain in the ground for 2-3 weeks to allow the skins to set. Skin set can be tested by pushing the thumb across the surface while pressing firmly downward. – if the skin comes away readily then the skins are not sufficiently set and tubers should be left to mature for another week. Waiting for good skin set avoids too much dehydration in store.

Whether you are planning on buying your own harvester or employing a contractor to lift the crop, it is essential that the tines on the harvester webbing are not too far apart. Harvesters set up for ware crops may have wider webs to allow more stones, mud and undersize potatoes to drop out but this will result in the loss of many of the smaller tubers if used in a

seed crop. Prior to harvest SPL will provide the grower with a suitable number of one tonne boxes for the crops to be harvested into. If more than one crop is being grown at the same holding great care must be taken to avoid admixture. Boxes must be clearly labelled and the harvester must be thoroughly checked to ensure no tubers from the previous crop are present on the machine before moving into the next crop.

Once harvest is complete the crops will be taken to a central store to be stored and graded. SPL will cover all the costs associated with storage and grading but individual growers will be encouraged to visit the grading site to gain first-hand experience of the grading process. Growers will be paid an agreed rate on all 35/55mm certified seed once tuber inspections have taken place. Good crop management and careful harvesting should ensure the maximum number of 35/55mm tubers with low levels of over and under-sized tubers (outgrades). This will provide the best return for the grower.

3. Crop inspections and the Seed Potato Classification Scheme

3.1 Introduction

For the crop you have produced to be certified as seed, it has to meet the specifications laid out in the Seed Potato Classification Scheme. The Scheme is designed to keep UK seed crops, and the subsequent ware crops they produce, as healthy as possible. Potato crops in the UK are vegetatively (clonally) propagated meaning that, genetically speaking, the same plant is grown year after year: the mother plant produces tubers which are harvested and re-planted to produce the next generation. This can quickly result in a stock building up a range of pests and viral and bacterial diseases which can affect the viability and yield of future generations. To combat this the UK has adopted what is known as a “flush-out” system where new, 100% disease free minitubers enter the system each year and the oldest stocks cannot be re-planted. Countries that do not have systems of seed certification like this suffer from poor yields, primarily due to virus build up in older stocks.

3.2 Grade and Field Generation

Initial disease-free material is produced in licensed laboratories, where 100% disease free plants are maintained in tissue culture. Tiny microplants from tissue culture supply cuttings that are grown on in compost in special greenhouses. The plants produce minitubers about the size of a walnut. When minitubers are first planted in the field they are described as Field Generation 1 (FG1, see table below). Each year a stock is replanted, it increases its FG by 1. When a stock is FG9, it cannot be replanted to produce seed. Every seed stock is given a Category and a Grade depending upon the field generation and on the levels of purity and of health of the stock when inspected. SPL staff will manage crop applications to APHA initially until growers feel confident to apply for themselves.

Grade	Category	Field Generation	Rotation (years since land last grew potatoes)
PB	Pre-Basic	1-4	7
S	Basic	5	5
SE	Basic	6	5
E	Basic	7	5
A	Certified	8/9	4
B	Certified	8/9	4

PreBasic seed is produced in small quantities and is too valuable to sell. By the time seed is Basic grade it has been multiplied many times and is then available for sale or for replanting to produce more Basic seed. Most of the seed we will be producing is Basic seed of FG 5-9 so the requirement is a five or four year rotation, ie the fields you select must not have held a potato crop of any kind for at least five years. No stock can be grown for seed for more than nine years in Wales and this reduces to seven years in Scotland and some areas of northern England and N. Ireland (the “protected regions”).

3.3 Isolations

As well as obeying the correct rotations, different grades of seed must be grown certain distances apart from each other. These are known as statutory isolations. As with the rotation requirements, isolations refer to distances from *all* potatoes not only from other seed crops. Depending upon the grade of the planting stock, crops can be grown as close as one row width apart i.e. one blank row between stocks but isolation from ware crops is 50m.

You must be aware of other potatoes that may be growing near to your seed crop. These include those being grown in gardens or allotments. Full details of all isolation requirements will be discussed with individual growers pre-planting and can be found at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/523572/S_PCS-guide.pdf. Crops are downgraded or failed every year because proper isolations are not being kept; seed inspectors have been instructed to enforce isolations properly.

3.4 Inspections of growing crops

To ensure that seed potato crops are properly planted and adhere to the necessary levels of disease freedom and varietal purity they must be inspected by specially trained plant health inspectors from APHA. Certified seed crops of grades A and B are inspected once but higher grade stocks are inspected at least twice, with the two inspections being roughly a fortnight

apart. First inspection is usually carried out when the plants are touching in the row and displaying their mature plant characteristics but are not yet touching across the row. This makes the crop easier to walk through for the inspector and also allows a clear view of the base of the plants where some problems are easier to identify.

Inspectors are looking for plants that are not true to type (i.e. do not look like the variety we say we have planted) and those showing symptoms of certain viral and bacterial diseases. These are diseases that can rapidly build up in a seed stock and if not removed from the growing crop can cause severe problems in subsequent crops. Each grade of seed has a tolerance level for each particular defect with higher grade stocks demanding higher levels of purity to attain certification, as detailed in the table below.

Defect	PB	S	SE	E	A	B
Not true to type	0.01%	0.1%	0.1%	0.1%	0.2%	0.5%
Blackleg	0%	0.1%	0.5%	1%	2%	4%
Virus Y, A + leafroll	0%	0.02%	0.1%	0.4%	2%	6%
Other virus	0.1%	0.2%	0.5%	0.8%	2%	6%
Total virus	0.1%	0.2%	0.5%	0.8%	2%	6%

For pre-basic (PB) crops, the tolerances above apply to both first and second inspections. For other grades, the virus tolerances apply to all inspections whilst tolerances for blackleg and off-types apply at the final inspection only. Based upon the findings at inspection an inspector can pass, downgrade or fail a crop. For example, if a crop entered for certification at SE was found to have more than 0.5% blackleg at second inspection, it could not be certified at SE but could be certified at a lower grade depending upon the level of infection. More than 4% blackleg (the tolerance for the lowest grade, B) would result in the crop failing outright.

A third inspection may sometimes be needed if the crop has been heavily rogued (had off types and diseased plants removed by the grower) or if the inspector needs to check that the crop has been burnt off by an agreed date due to the presence of excessive virus. The virus disease resistance in Sarpo varieties makes this situation very unlikely.

3.5 Pre-inspection crop walking and “roguing”

To avoid having a crop fail or being downgraded at its inspection it is essential to walk the crops just before inspection and remove any diseased or off-type plants. This is known as roguing.

Of the most important potato virus diseases – potato virus Y (PVY), potato virus A (PVA) and potato leaf roll virus (PLRV) – only PVY has been recorded in one crop of Sarpo Gwyn since we have been growing seed in Wales. The virus resistance in the other Sarpo varieties is extraordinary. However, it is important to be able to recognise the symptoms of “severe mosaic” and if in any doubt remove the plants and burn them. Do not leave plants suspected of carrying virus at the ends of rows or elsewhere in the field as aphids (the main transmitters of many potato viruses) can still feed on these and infect elsewhere in the field. It is also important to kick out the space in the row where the plant was growing to remove any small tubers that may have formed and prevent these being harvested with the healthy crop.



A yellowish mottling of the leaves, made more apparent if a sheet of white paper is held underneath, is a good diagnostic feature of a plant with PVY or PVA infection. Severely infected plants will look crinkled and visibly stunted compared to their healthy neighbours. Plants infected with PLRV will look “pointy” and their lower leaves will feel hard and brittle.

The most common disease you are likely to find in your seed crops is blackleg, a bacterial soft rot caused by *Pectobacterium atrosepticum*. Initial symptoms can be a yellowing of the upper leaves and a ‘pointy’ appearance to the plants. The lower portion of the stems (see photo below) will be dark brown or black (the infection spreads upward from the infected seed tuber) and will smell foul. Eventually the whole plant collapses. The diagnostic stem discolouration is one of the main reasons that inspectors should be able to see the base of the plants at first inspection. As blackleg is primarily seed borne it is of great importance that all infected plants are removed and all tubers cleared from the drill to prevent infection of

future generations. Blackleg is worse in cool, wet summers so be especially vigilant in these conditions.



The most common problem you are likely to encounter in your crops is not caused by disease though, but by a few tubers of another variety being planted amongst your crop. These should be removed in the same way as described above. In some cases these “rogues” are very easy to spot – a plant of Blue Danube with its dark stems and striking purple flowers is almost impossible to miss. However, the varieties Sarpo Mira and Axona can look very similar, particularly in early growth stages, and are more difficult to tell apart generally.

The picture below shows leaves of Axona (top) and Sarpo Mira (bottom). Axona is generally darker with sharper looking leaves and more “secondaries” (the smaller leaflets clustered along the leaf rib). Sarpo Mira is rounder, paler and with fewer secondaries. Tubers of both varieties are red skinned but Sarpo Mira is white fleshed while Axona is yellow fleshed. These descriptions are general and there will obviously be some variation due to site, stage of growth and the growing season itself. Due to the similarities between these varieties we would not encourage the growing of both crops on the same holding.

Roguing is an essential element of the seed production process. Not only does it minimise the risk of crops being failed or downgraded in the field, it also ensures that the crop that is harvested is as clean and as true to type as possible. SPL staff will be on hand to rogue crops with growers and provide training so that growers will be able to do so independently.



4. Post harvest storage, grading and tuber inspections

As all the seed produced will be stored and graded at a central store, rather than on individual grower's holdings, we will only discuss this briefly here.

Before seed can be marketed the tubers must be inspected at least once after they have been graded. As with the in-field inspections, this is to ensure that the seed meets the requirements for the grade applied for. Again, higher grades of seed have tighter tolerances for various pests and diseases as well as physical damage. One of the main reasons why destoning prior to planting is desirable is that it reduces damage caused by stones at harvest. Not only is damage a cause for rejecting tubers in itself but it also acts as a route for infection by various storage rots. The diseases/rots most commonly removed during grading are

bacterial soft rot (foul smelling), common scab, late blight of tubers (a firm rot), dry rot, gangrene and black scurf. Small amounts of these diseases are tolerated in stocks; the tolerance levels are prescribed by each grade of seed.

Stocks of potato seed on continental Europe are sometimes infected by bacteria, causing Ring Rot or Brown Rot. These two non-indigenous rots must be kept out of U.K. Thus, tubers are sampled by the inspectors and sent to labs for testing for the presence of these diseases. There is a risk that these diseases will become established in U.K. and thus many merchants are reluctant to import seed. It would be no surprise if Brexit resulted in a ban on seed imports.

5 References

Explanatory Guide to the Seed Potato Classification Scheme, APHA:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/523572/SPCS-guide.pdf

Sarpo Potatoes Ltd website: www.sarpo.co.uk

AHDB Potato Variety Database: <http://varieties.ahdb.org.uk/>

AHDB Blightwatch website: www.blightwatch.co.uk

The Sustainable Potatoes Wales team

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