Setting up a small scale tree nursery

Introduction

There is increased interest in collecting tree seeds by community woodland groups in Wales, to grow-on in small nurseries into seedlings or transplants. The purpose of this short guidance note is to provide a brief checklist of what is needed to grow small quantities of good quality native trees and to point readers towards relevant sources of more detailed information. It is mainly aimed at woodland managers who have collected their own local tree seed and wish to grow trees for their own use

Why grow your own trees?

As a woodland manager there are many potential benefits to growing your own planting stock, using locally collected seed. Growing self-collected seed offers many educational and other social engagement opportunities, and the activities can be carried out by volunteers of all capabilities. Woodland managers may want to propagate trees of local provenance or produce stock from a particular individual tree that they value, and personally collecting seed is one way of achieving this. It is important to be clear about your reasons for growing trees – how many trees do you need and what are they for? Is the intention ultimately to produce good quality timber or are other ecological benefits more important? It is possible to establish a woodland by simple direct-sowing seed at the site. However, although this is a low-cost method, the success rate is unpredictable and generally unsuccessful on wet sites and in established woodlands habitats due to predation losses by seed-eating mammals and birds. At these sites, planting nursery-grown, well-rooted seedlings or transplants will be more successful.[11] If you wish to establish more trees in an ancient semi-natural woodland, encouraging natural regeneration may be more appropriate and could be more successful in the longer term.

Growing small quantities of trees is relatively straightforward and can be done with very little horticultural experience, but producing larger numbers of good quality growing stock requires a greater level of commitment, planning and skill. Large commercial tree nurseries have many years of experience of growing quality-assured growing material and can keep operating costs down due to the scale they work at. Consequently, they can offer planting stock for sale at very competitive prices. Whilst cost-saving or generating an additional income are often the main motives for setting up a small-scale nursery, these are not easily achieved.

Legal obligations

If you intend to market any of the grown-on trees that you propagate then you need to abide by the Forest Reproductive Material (FRM) regulations (2002). As part of this, you will need to register as a supplier and maintain good records of the seed and growing stock that you produce. A Master certificate must accompany any trees that you sell so that it is fully traceable all the way through from seed to tree. More details are provided in *Legal obligations when collecting tree seed in Wales.* Defined standards and operating protocols have been produced to manage plant health risks in tree nurseries (Plant Health Alliance Steering Group, 2019). Although aimed at large producers, parts are equally relevant to small nurseries.[1,2,12]

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Setting up a small tree nursery

One of the first decisions you must make is the size and type of production system that is appropriate for you. If your resources are limited or you don't have previous nursery experience it is important not to be too ambitious – start small, learn how to make it work and you can expand the nursery at a later date. Although every nursery is different, there are three production methods that are used for propagating tree seed:

"Field grown", where the trees are grown entirely outdoors and seedlings planted as 'bare-rooted'.

"Cell grown", where the trees are grown in individual cells (root-trainers) in polytunnels. Cell grown stock are more expensive to produce, but the roots are not disturbed so much when planted out, so may survive better.

"Cell-Field hybrid", where the trees are started off in root-trainers in a polytunnel but are then transferred to outdoor beds to be grown-on.

Whichever system you use there are four essential requirements for every successful tree nursery:

Suitable location: A rough guide to growing areas (nursery beds / lining out beds / polytunnels) needed is ~130-170 plants per square metre for container-grown or 40-100 plants per square metre of prepared ground for field-grown. You will also need similar amounts of space for hardening stock off and, if possible, buildings for storage of tools, potting-up, seed storage/stratification, etc. It also helps considerably if your nursery site is flat, sheltered from strong winds, and well-drained. Sites facing south can have problems with overheating, whilst north-facing hollows can be frosty and seedlings can easily be damaged if they become too dry or freeze. The site also needs to be secure, especially in areas where vandalism is an issue.

Water supply: A reliable sources of water is essential. Seedlings are extremely sensitive to drying out, so a sufficient, consistent year-round water supply must be available. If you are thinking of extracting water from a natural supply you should consult NRW in case an extraction license is required. Careful planning of how irrigation will be supplied to your seedlings is critical.

Access: The nursery must be safe and accessible at all seasons and ideally close to a road so that materials can easily be delivered, and trees moved off. Make sure that permission for use of the land as a nursery has been clearly given.

Time: The amount of time needed to grow good quality trees should not be underestimated. Seedlings will always do their best to survive, but they are far more likely to thrive and grow into healthy, well-rooted adult trees if they are kept watered, weed-free and transplanted correctly. The busiest seasons tend to be Spring when seed needs to be sown, and Autumn when seed is collected, processed and seedlings are potted-on/transplanted. However, some nursery work will be needed in every month of the year. The Table below gives an indication of the timing for various nursery activities.[4,5,6]

Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Seed collection					X	X	X	XX	XX	XX	XX	
Seed stratification								XX	XX	XX	XX	X
Sowing		XX	XX	XX	X	X				XX	XX	
Weeding				XX		XX	X		X			
Watering			X	X	XX	X	XX	XX	X	X		
Pest control			X			XX	X	XX	X			
Hardening off							X	X	X	X	X	
Transplanting / potting-on	X	X				XX	X			X	XX	XX
Grading	X	X							XX	XX	XX	XX
Equipment maintenance	X	X	X							X	X	X
Tree planting	X	X	X							X	X	X

Financial resources: The resources you have available must be considered carefully. The most valuable resource is a reliable supply of labour (and someone to supervise them). Micro-scale nurseries producing bare-rooted growing stock can be run with lower costs but if you wish to grow seed in cells, then the cost of polytunnels, watering systems, root-trainers and the growing medium have to be accounted for.[3]

Essential Nursery activities:[3,4,5,6,9]

Seed storage: Beginning with the seed you have collected, the first task in the nursery is to clean and process it so that it can be stored safely until it is ready to plant. Seeds from fleshy fruits must first be extracted, either by hand or mechanically depending on the quantity you are dealing with. Once cleaned, many seeds can be stored cool and dry (but not too dry) until planting time. Other species will not germinate unless they have gone through a period of cooling, and they need to be stored carefully at the correct humidity and temperature for up to two years. A fridge is useful for storing some seed in bags, others can be stored in damp sand-compost mix in pest-proof containers outdoors. Some species such as Oak are highly perishable and acorns must be planted immediately.[3,4,5,8]

Sowing: There are two main sowing seasons – Autumn for perishable seed such as Oak, and Spring (when ground frosts are no longer a risk) for most other species. Small seed can be broadcast into prepared beds or seed trays to be pricked-out later. Larger seed can be planted individually.

Seed storage for different tree species

Difficult to store. Sow immediately	Store dry & cool for 1 winter	Stratify – store in a cool, moist medium for 1 winter	Stratify – store in a cool, moist medium for 2 or more winters
Oak	Alder	Bird Cherry	Ash
Aspen	Birch	Blackthorn	Hawthorn
Beech	Pine	Crab Apple	Holly
Poplar	Broom	Elder	Yew
Sweet Chestnut	Gorse	Field Maple	Dog Rose
Willow		Hazel	Spindle
Wych Elm		Rowan	
		Wild Cherry	
		Guelder Rose	

Open grown / raised beds (bare rooted) system: Suitable beds will need to be prepared well before you need to sow. Depending on scale, you can do this using hand tools, rotovators or larger farm machinery. Soil quality is important, fertility is important, but so is being well-drained, and having good texture with plenty of organic matter so that a tilth can be formed that doesn't dry out too quickly. Raised beds, where soil is heaped up into strips between pathways work well, but make sure they are not too wide or else weeding will be difficult.

Cell-grown system: Pure soil is usually too dense to encourage good tree growth so a prepared growing medium will be needed to fill the cells. This can either be bought in, or home-made using a mix of sand, vermiculite / water retaining granules, lime, fertilisers, etc. Containers are best raised off the ground on staging or benches (this allows an air gap underneath, encourages root growth inside the cells and also makes pest control and potting-up easier). If indoor space can be provided for filling cells and planting seed this makes the work far less arduous and less dependent on weather.

Watering: This is critical to keep the seedling healthy and actively growing. Light-seeded species such as Birch and Alder are especially sensitive at the early stages of growth. Too much watering however can also cause problems. Watering by hand is time consuming and can quickly become a chore, so automated systems using sprinklers or drip-lines are really useful and can reduce the volumes water needed– but still need frequent manual checking. Water requirements during the summer months can be high, so make sure you have an all year-round supply and permission to abstract if needed. Rain water storage can be useful, especially of you have buildings with large roofs on site.

Weeding: This is also very important to ensure the production of well-grown seedlings, but can become very time consuming. It is better to remove weeds early, before they compete with the tree seedlings and roots become difficult to separate. Weeding of cell-grown plants is essential and is less back-breaking if staging is raised to a suitable height. For open-grown beds a mulch of fine sand over the soil surface can help to suppress weeds or a chemical herbicide might be used. If any herbicides are used, always follow the instructions regarding application rates, safe use (especially near watercourses), storage and disposal.[10]

Feeding: The soil or growing medium should be able to supply all the nutrients for the very young seedlings but to maintain growth later in the year supplementary feed may be useful. For cell-grown stock, liquid fertiliser (either home-made or bought-in) can be applied by watering-can or via drip-lines if you are using them (fertigation). For field-grown stock, granular fertiliser or mulching with manure, etc can also be used.

Pest control: Both seed and seedlings are vulnerable to a wide variety of pests and need to be controlled to prevent losses which can be both frustrating and expensive. Mice, rodents and squirrels can dig up sown seed so they need to be excluded using fine chicken-mesh and raising cells / seed trays off the ground on staging can help. Very young seedlings are very susceptible to over-watering and mildews, fungal rusts and Blackfly can also cause problems. Older seedlings can be attacked by grazing animals such as rabbits, sheep or deer so if these are present, the site may need to be fenced. Careful monitoring of the crop at all stages is needed to prevent significant losses.

Transplanting / undercutting: Normally field-grown seedlings remain *in situ* for up to one year and are then undercut (root-pruned) or transplanted to another bed to grow for a second year. This is done to encourage stronger root-growth that will sustain the tree when it is finally planted. If this is not done, seedlings tend to grow fewer roots or develop excessively long roots which make planting difficult. If root-trainers are used these can often be opened up to check whether the roots are growing well, the design of the cells should prevent the roots spiralling around which should be avoided.

Hardening off: Cell-grown seedlings can often be planted out in their first autumn when they are still in leaf, which means they can continue to establish themselves before becoming dormant. However, if they are grown in polytunnels then they should be acclimatised outdoors (hardened-off), several weeks before they are due to be planted.

Equipment maintenance: Another important task which should not be ignored is on-going maintenance of nursery equipment. If you are using seed trays of root-trainers then it is worthwhile cleaning them and storing them carefully. Root-trainers can be a significant expense but can be used repeatedly for five or six years if looked after. Hand-tools and any machinery also need to be well maintained to ensure that it is safe to use.

Health & Safety: Whatever the size of nursery, all staff / volunteers should be aware of the potential risks at the site and in the work involved. An appropriate First Aid kit should be provided, and ideally a trained first-aider present whenever people are working on site. It is the responsibility of the nursery manager to ensure that everyone is aware of the relevant safety procedures and these adhered to. Nursery work is similar to other woodland work and may involve the use of hand tools and machinery, manual lifting, and working outdoors in all weathers. Additional training will be required if hazardous chemicals are used and it is advisable that everyone handling soil or compost has had a tetanus immunisation. Although very rare, there are some diseases. such as Sporotrichosis. which can occur in nursery workers handling plant material. such as sphagnum moss in compost. Wearing suitable clothing (gloves and long-sleeves) that reduces the risk of skin abrasions is recommended.

Hygiene: Avoid importing plant diseases / pests – don't accept plant material or growing media from outside the nursery unless it comes from an accredited supplier with good hygiene standards; Any diseased plants should be destroyed immediately - burning is better than composting unless this can be done well and at a high temperature. Keep the nursery area clean and free of weeds as these may spread to the seed beds or harbour pests which can infect the growing trees. Keep work surfaces, tools and any trays or pots clean (diluted household bleach can be used with care).[14]

Key Points:

- ◊ Don't be too ambitious at first - start small and gain experience
- ◊ Plan ahead, prepare your nursery / seed storage before gathering seed
- ◊ Understand all the different processes required and decide which system will work best for you
- ◊ Make sure you have enough labour to carry out all the required work
- ◊ Successful nurseries tend to be those growing trees for a specific project and have a guaranteed destination for all the trees produced

Resources for tree nurseries

1. FC Forest Reproductive Material: Regulations controlling seed cuttings and planting stock for forestry in Great Britain (2019) online at: https://www.forestresearch.gov.uk/research/forest-reproductive-material-regulations-controlling-seed-cuttings-and-planting-stock-for-forestry-in-great-britain-2nd-edition/
2. Business Planning workbook for local provenance tree nurseries (2008) Wild Resources Limited Available online at: https://www.wildresources.co.uk/small-scale-tree-nurseries.shtml
3. FC Practice guide #18: Raising trees and shrubs from seed (2007). Available online at: https://www.forestresearch.gov.uk/research/raising-trees-and-shrubs-from-seed/
4. The Good Seed Guide. Tree council (undated) ISBN 0-904853-01-2
5. TCV Handbook: Tree planting & Aftercare. Chapter 6. Propagation:https://www.conservationhandbooks.com/tree-planting-aftercare/propagation/
6. Growing native trees from seed: A practical guide to tree nursery production. (undated) Cliff Webb, Glasu publication Available online: https://llaisygoedwig.org.uk/wp-content/uploads/2013/12/Glasu-Growing_native_trees_from_seed_tree_nursery_production_guide.pdf
7. FC Bulletin 121 (1999) *Forest Tree Seedlings – Best Practice in Supply, Treatment and Planting* Forestry Commission. Available online at: https://www.forestresearch.gov.uk/research/archive-forest-tree-seedlings/
8. Collins Guide to Tree planting & cultivation(1970) Edlin H.L. Published by Collins ISBN 0 00 219159 8 (Old, but good introduction)
9. FC Bulletin 111. Forest Nursery Practice (1994). Aldhous, J.R. Available online at:https://www.forestresearch.gov.uk/research/archive-forest-nursery-practice-2ed/
10. Pesticides: Code of practice for using plant protection products (applies to Herbicides) DEFRA (2006). Available online at: https://www.hse.gov.uk/pesticides/resources/C/Code_of_Practice_for_using_Plant_Protection_Products_-_Complete20Code.pdf
11. FC Practice Guide 16 (2004) Creating new Broadleaved woodland by direct seeding. Available online at: https://www.forestresearch.gov.uk/research/creating-new-broadleaved-woodland-by-direct-seeding/
12. Plant Healthy: Plant health management standard: general requirements for plant growers and suppliers (2019). Available online at: https://planthealthy.org.uk/resources
13. Forest Research note: Biosecurity: Plant health for the horticultural sector. Available online at: https://planthealthy.org.uk/resources/plant-health-for-the-horticultural-sector-key-considerations

LLAIS Y GOEDWIG
The voice of community woodlands in Wales

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