



Reproductive Material No. 4

The Collection Storage, Treatment and Handling of Broadleaved Tree Seed

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- Broadleaved trees are an important component of the Irish landscape.
- There is a new and increasing interest in broadleaved trees, especially the native species.
- For improved productivity use only the best seed sources, while conforming to national and European Union seed regulation.
- Broadleaved tree nuts and seed vary in size and shape, ranging from husks or berries to dry seed with and without wings.
- Seed production is cyclic in all species, particularly broadleaves, with infrequent mast years in many of the species due to many different factors.
- Tree seed can be categorised into two main categories, orthodox and recalcitrant. Orthodox seed can be stored for long periods at low temperatures and low moisture content without loss of viability.
- Recalcitrant seeds, which are difficult to store, are a characteristic of some broadleaved species.
- Attention to detail is important when collecting, processing and storing broadleaved tree seed.

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Introduction

The broadleaves, or hardwood trees, are an important component of the Irish landscape. In the past they were one of the country's main sources of building material, fencing and fuel. Today broadleaves remain an intrinsic part of our landscape, as well as being an important and increasing component of our forests. While the depletion of our hardwood resource continued for many years, today the trend is being reversed through the national strategy and other initiatives, such as the new Native Woodland Scheme, which have increased interest in broadleaves in Ireland. To improve the productivity of our broadleaved woodlands, use of seed from stands of high inherent quality is widely recognised as the best means of ensuring vigorous and healthy forests capable of yielding best quality timber crops.

Seed Sources

It is important to use only the best and most suitable seed sources available. Where possible, seed collected from registered Irish seed stands should be used. When Irish reproductive material is unavailable, use material from Britain and mainland Europe where general climatic conditions are similar to those in Ireland. Only use material from registered seed stands.

Flower, Fruit and Seed Development

Some woody plants naturally multiply by vegetative means but almost all trees produce seed as their principle means of perpetuation and dispersal. The processes by which these seeds are formed are complex and differ greatly between species. They are susceptible to environmental factors which can either increase or diminish the quality and quantity of seed finally produced in any year.

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Cherry (Prunus avium) branch with processed seed in dish.

In common with all woody plants, broadleaved trees pass through a juvenile or vegetative period during which they are physiologically incapable of flowering or producing fruit. The length of this phase varies from species to species, and there is also variation within species. Each genus of broadleaved tree exhibits its own peculiarities of flowering. Male and female flowers are borne on different trees (dioecious) or separately on the same tree (monoecious). Alternatively the male and female parts may occur in the same flower.

Wind-pollinated flowers often open before the leaves, as in poplar, or concurrently with the unfolding of leaves, as in walnut, but this is not always the case. Beech produces flowers just after the foliage has emerged. A common feature of wind-pollinated flowers is the lack of accessory floral parts, resulting in rather inconspicuous flowers like those of elms and ash, but the most common feature of many wind-pollinated species is their production of catkins. Conversely, insect-pollination normally occurs in those species with brightly coloured or scented flowers, as in cherry.

The task of assessing a potential seed crop in broadleaved trees can be quite difficult. Acorns of most of the oak species only develop sufficiently to be visible without really careful examination in late August and September. The presence of flowers in spring is not a reliable indicator of a seed crop. Frosts can be particularly devastating to the oaks, as they tend to flower before full leaf extension and at a time when frosts are still likely to occur.



Birch branch with female catkins containing seed.



Birch branch with dry processed seed in dish.

One of the most important, and possibly least understood, problems associated with tree seed collection involves the irregular and unpredictable production of flowers, fruit and seed. This varies among species, among trees of the same



Branch from a rowan tree carrying the new season's berries, and processed dry seed in dish.

species and from year to year in the same tree. For more precise information see Table 1. Hardwood fruit and seeds vary in size and shape, ranging from those in husks like beech, or berries like rowan, to those that are dry and may or may not be winged. In general, seed should be separated from its husk if dry, or from its soft coat if it is a berry. Birch seed has small wings and has to be sown with the wings remaining



Beech branch with current season's beech nuts.

on the seed coat, while the wings can be removed from seed like sycamore. Pulpy fruit should be macerated before sowing, by squashing or gently mashing it and mixing with water. As a result, pulp and skins can usually be separated from the seed by washing through a sieve to remove heavy material and by flotation in water to remove unwanted light material.

Table 1 Crop forecast data for seed of commercial broadleaved trees. (Adapted from Forestry Commission Bulletin No 83 - Seed Manual for Forest Trees).

Characteristics

SPECIES	Age at first good seed crop (Years)	Age at maximum production (Years)	Periodicity of fruiting (Years)	Period for crop assessment	Timing of cone collection		
					Earliest	Normal	Latest
Birch (<i>Betula spp.</i>)	15	20-30	1-2	July	Aug	Sept	Oct
Beech (<i>Fagus sylvatica</i>)	50-60	80-200	2-8	July - Aug	Early Oct	Oct-Nov	Late Nov
Sessile Oak (<i>Quercus petraea</i>)	40-50	80-200	3-8	Aug	Early Oct	Oct	Early Nov
Pedunculate Oak (<i>Quercus robur</i>)	40-50	80-120	2-6	Aug	Early Oct	Oct	Early Nov
Red Oak (<i>Quercus rubra</i>)	30-40	80-120	2-3	Aug	Late Aug	Sept	Oct
Common Ash (<i>Fraxinus excelsior</i>)	15-20	20-40	1-2	Aug - Sep	Sep	Oct	Nov

Regulation of Seed Collection

During the 1960s, when large quantities of forest tree seed were traded internationally, the Organisation for Economic Co-operation and Development (OECD) developed a Seed Certification Scheme to guarantee the authenticity of this seed.

When Ireland became a member of the European Economic Community in 1973, collection and marketing of forest tree seed of a number of broadleaved trees became subject to the European Communities (Forest Reproductive Material [FRM]) Regulation, 1973. Under this regulation the country was classified as one region of provenance. The regulation required the establishment of registered seed stands for scheduled species.

Since that time, the control of the quality of reproductive material has been regulated through the European Union (EU) Directives on the marketing of Forest Reproductive Material. There are currently two EU Directives governing FRM, namely Council Directive 66/404/EEC on

marketing and Council Directive 71/161/EEC on external quality standards. These Directives set out the requirements relating to genetic characteristics and external quality which forest reproductive material must satisfy before it may be marketed in the Community. Currently these regulations are only applicable to the following broadleaved species: beech, poplar and some of the oaks (red, pedunculate and sessile).

From 1 January 2003, the current Directives will be replaced by Directive 1999/105/EC. This new Directive will cover a much wider range of species of importance for broadleaved forestry in Ireland, including ash, alder, birch, sycamore and cherry. Under the new Directive there is a legal requirement for suppliers of forest reproductive material throughout the European Union to be registered with the regulatory authority. In Ireland the regulatory authority is the Forest Service, Department of Communications, Marine and Natural Resources. Under the Regulations, each lot of seed and fruit must be clearly labelled at all stages from collection to sowing.

Collectable mature seed bearing trees per hectare		Weight of seed per tree (kg)		Weight of seed per hectare (kg)		Collection potential (kg per man day)		Weight (g) of one litre of fruit
Average Crop	Heavy Crop	Average Crop	Heavy Crop	Average Crop	Heavy Crop	Average Crop	Heavy Crop	
20	60	1-3	3-6	3-10	6-20	2-5	-	-
20	40	8-10	15-20	150-200	400-600	1	3	400-500
20	40	20-40	17-90	500-700	<3200	50	-	500-700
15	30	30-50	110-130	500-700	<3600	50	-	600-800
15	30	30-50	110-130	500-700	<3600	50	-	500-700
20	40	5-8	10-12	-	-	-	-	-

Seed Collection

The cheapest method of seed collection, used widely throughout the world, is the employment of casual labour under supervision and with payment based on the quantity collected. Species that drop their seeds are the easiest to collect from as they can be picked up or swept up. However, these types of seed are often attractive to animals as a food source, so collection must not be left too late as local fauna can deplete the entire crop over a few days.

Heavy seed crops often follow a year with a prolonged hot, dry summer and collection costs are reduced in heavy crop years. It is common practice to collect several years' supply of seed for those species for which the seed can be satisfactorily stored for long periods. The method of collection of fruit and seeds of broadleaved trees varies with species.

For oak and beech, the acorns and beechnuts, respectively, are picked from the ground below the seed trees. To facilitate this, the ground should be cleared of all debris. Alternatively, hessian sheets or tarpaulins should be spread around the base of the seed trees. These should only be put in place after the first fall of empty and unsound seed. Collections should be made in dry weather since moist fruit will frequently become warm and go mouldy, even during temporary storage. When in doubt about seed quality, it is always best to carry out a physical examination through a number of random cut tests (i.e. cut a number of seeds in half and observe whether the seed is full or empty). Storage bags must be porous and should be kept well ventilated. Open woven hessian sacks that permit the free movement of air are most suitable. Polythene bags are not suitable containers for newly collected seed.

Berries of rowan, holly and hawthorn should be picked when fully ripe. Birch catkins and alder cones must be picked in late September or early October, depending on



Oak acorns cut to test seed quality and germination ability – showing decayed (left) and viable (right) acorns.



Ash branch with green samaras and dried ripe brown samaras containing seed.



Common alder branch (Alnus glutinosa) carrying new cones, with dry seed in dish.

the weather but before the catkins break up or the alder cones shed the seed.

Elm seeds should be swept from the ground as soon as possible after the seed has fallen. Alternatively, it may be picked from the tree between mid-May and early June when the green pigment in the seed wing has disappeared and the seed is fully developed. Ash and sycamore seed is usually gathered from the seed trees in late September or October, again depending on the season. Collection of seed from the ground is sometimes feasible, especially where there has been a heavy fall, but this method is usually slow and expensive and is unlikely to provide seed of the best quality.

Seed Processing

The methods used for processing seeds so that they can either be stored safely, or efficiently pre-treated, are closely related to their morphology. Thus acorns need different treatment from berries. Unless acorns and beech mast are to be cleaned further, the best method of maintaining quality is to sow the seeds immediately after collection in protected seedbeds.



Hawthorn branch with berries, and processed dry seed in dish.

Seed Storage

The storage of seeds of commercial forest species has received considerable attention over the years. Seeds have been found to fall into two main categories, i.e. “orthodox” and “recalcitrant”:

- Orthodox seeds can be stored successfully for long periods at low temperature and low moisture content.
- Recalcitrant seeds die if their moisture content is reduced below some relatively high value. Oak is considered one of the most difficult seeds to store and can be categorised as recalcitrant seed. It is considered almost impossible to store seeds of most of the oak species for long periods without major loss of viability. The best that can be hoped for is that storage conditions can be controlled to keep deterioration within acceptable limits until acorns are required for sowing in the spring after collection.

As a broad rule, most species of a genus behave similarly: either all are orthodox or all are recalcitrant. However, there are some exceptions, for example while beech seed is



Pendunculate oak branch with new acorns next to one-year-old stored acorns.

classified as orthodox, in practice it is difficult to store successfully for the long term and has many of the characteristics of recalcitrant seed.

Additional Sources of Information

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