
# The Collection, Storage, Treatment and Handling of Conifer Tree Seed

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- Seed collection should be confined to good seed years when seed quality is at its best and collection costs are lowest.
- A thorough understanding of crop assessment and collection methods of cone and seed crop is essential.
- Cone and seed crops are influenced by climatic conditions at time of flowering and during seed development and ripening.
- National and EU regulations exist to protect consumers and to ensure that all plantations are established with healthy planting stock of the prescribed provenance, as chosen by the forest owner.
- Seed collection can be made from standing trees by climbing, or from felled trees.
- Any person intending to make a seed collection must first register with the Forest Service as an official seed collector.
- Forest reproductive material (seed, cones or cuttings) cannot be legally marketed for forestry use unless it is properly certified.
- The collection of seed from a forest plantation could be an additional source of income for growers.

## Introduction

The use of sound seed from stands of high inherent quality is widely recognised as the best means of ensuring fast-growing and healthy plantations capable of yielding good quality wood. Seed that is guaranteed to have been collected in seed orchards, or in selected seed stands or seed production areas, may be slightly more expensive than wild seed. Nevertheless, the higher cost of collecting seed from these sources adds very little to the costs of the newly established plantation. Some woody plants multiply naturally by vegetative means but almost all trees produce seed as their principle means of perpetuation, dispersal and survival. The seasonal process by which tree seeds are formed are complex, differ greatly from species to species and are very susceptible to the influences of climatic factors. These factors will either increase or reduce the quantity and quality of seed produced from year to year. Through an understanding of the process, it is possible for the seed collector to make an early assessment of potential seed crops. The seed crop of a forest is a valuable resource and should be regarded as a potential additional source of income for the owner.

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## Flower, Fruit and Seed Development

Every effort should be made to collect seed in good seed years when cones are plentiful, the quality of the seed is at its best, and cost of collection is reduced. Everyone involved with the assessment and collection of cones and seed crops requires a basic knowledge of flower, fruit and seed development. Seed is produced through a complex cycle of biological events, from the initiation of the flowering buds to their development, pollination, fertilization and finally seed formation. This cycle is normally completed in most conifers (gymnosperms) over an eighteen-month period while pines require an extra year. There will be slight variations from year to year, depending on climatic changes, location of stand and location of individuals within the stand. For example, edge trees with larger and more extensive crowns tend to produce larger quantities of seed on a more frequent basis. It is widely reported that a long, warm, dry summer is usually followed by a good seed year. All conifers are monoecious, meaning separate male and female flowers occur on the same tree, and in some species male and female flowers are easily distinguishable from each other.

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## Factors Affecting Cone and Seed Crops

The irregular and unpredictable production of flowers, fruit and seed is one of the most important, and least understood, problems associated with tree seed collection. It is difficult to make an accurate assessment of the seed potential of a particular stand. Many factors affect yield, including weather conditions at time of pollination. Continuous heavy rain throughout the period when female flowers are receptive can reduce the number of successful cross-pollinations and consequent fertilisations, resulting in a low seed set and poor yield per cone. Insects can cause extensive damage throughout all the stages of seed development. With Douglas fir and noble fir, the seed in poor seed years can be heavily infested with seed flies. Similarly, an air frost at just the wrong time can have a devastating effect, although the differences in the levels of susceptibility of individual trees in a stand can be dramatic, due to variability of stages of flower development, aspect, altitude and location. Even after the reproductive stage has been reached, the individuals of most temperate zone tree species do not flower every year.

## Regulation and Seed Collection

Forest reproductive material (FRM) is a collective term used to describe seeds, plants and other propagating material required for forestry purposes. Since Ireland became a member of the European Union (EU) in 1973, a number of EU regulations have applied to FRM. The regulations are designed to give consumer protection and are intended to ensure that anyone establishing a plantation is supplied with healthy planting stock, genuinely of the provenance or origin chosen by the forest owner.
There are presently two EU Directives governing FRM, namely Council Directives 66/404/EEC and 71/161/EEC. However, with effect from 1 January 2003, the current Directives will be replaced by a new Council Directive, 1999/105/EC. These Directives set out the requirements relating to genetic characteristics and external quality, which FRM must fulfil before this material is marketed in the Community.

*Table 1: Conifer species controlled by current EU Regulations.*

| Common Name | BOTANICAL NAME |
|---|---|
| Silver fir | *Abies alba* Mill |
| European larch | *Larix decidua* Mill |
| Japanese larch | *Larix leptolepis* (Sieb.&Zucc.) Gord. |
| Norway spruce | *Picea abies* Karst |
| Sitka spruce | *Picea sitchensis* Trautv.et Mey |
| Austrian & Corsican pine | *Pinus nigra* Arn. |
| Weymouth pine | *Pinus strobus* L. |
| Scots pine | *Pinus sylvestris* L. |
| Douglas fir | *Pseudotsuga menziesii* (Poir.) Britt |

The marketing of reproductive material (seed, cuttings and plants) of the EU species used for forestry purposes is covered under the current regulations until the end of 2002 (Table 1). There are currently only two categories of FRM, viz. "selected" and "tested", while a new category of "source identified" will be introduced in the new Directive.
Each Member State is required to compile and maintain a National Catalogue of reproductive material within its territory. Collection of seed of the controlled species must be made only in registered stands included in the official National Catalogue.
The new Directive also updates the legislation to take account of the accession of new Member States since 1975.

## Seed/Cone Collection

The method of collection depends on the terrain, spacing between trees, species and age and management of the stand. The easiest and cheapest method of collection is from felled trees. However, properly trained climbing teams can make cost effective collections and this method should not be dismissed.
Any person proposing to collect cones or seed of EU species, to be marketed within the EU, should first obtain permission to make the collection from the forest owner, and then seek authorisation to collect by registering as an official seed collector with the Forest Service, Department of Communication, Marine and Natural Resources. In compliance with National and EU legislation, all reproductive material must be adequately labelled from collection site to seed-processing facility, and from there to nursery and finally to planting site. Seed collection must be authorised and, subject to certain conditions, a Certificate of Provenance is issued. Without this seed certification, reproductive material cannot be legally marketed for forestry use and any grant aid entitlement will be disallowed.


*A registered seed collector preparing to visit a cone collection site with sacks and labels to comply with seed certification regulations.*

*Table 2*

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

## Characteristics

| SPECIES | Age of first good seed crop (Years) | Age of maximum production (Years) | Periodicity of fruiting (Years) | Period for crop assessment | Timing of cone collection | | |
|---|---|---|---|---|---|---|---|
| | | | | | Earliest | Normal | Latest |
| ***Abies grandis*** Grand Fir | 40 | 45-60 | 3-5 | End May | Mid Aug | Mid Sept | Late Sept |
| ***Abies procera*** Noble Fir | 20 | 40-60 | 2-4 | Mid June | Mid Aug | Mid Sept | Mid Oct |
| ***Larix deciduas*** European Larch | 15-20 | 40-60 | 3-4 | May-June | End Oct | Dec-Jan | Feb |
| ***Larix leptolepis*** Japenese Larch | 15-20 | 40-60 | 3-4 | April-May | Sept | Oct | Nov |
| ***Larix x eurolepis*** Hybrid Larch | 15-20 | 40-60 | 3-4 | May | End Sept | Oct | Nov |
| ***Picea abies*** Norway Spruce | 30-35 | 50-60 | 4-5 | End June | Early Oct | Oct | Late Nov |
| ***Picea sitchensis*** Sitka Spruce | 30-35 | 40-50 | 3-5 | End May | Mid Sept | Oct | Late Oct |
| ***Pinus contorta*** Lodgepole Pine | 15-20 | 30-40 | 3-5 | June-July | Early Sept | Oct | Mid Nov |
| ***Pinus sylvestris*** Scots Pine | 15-20 | 60-100 | 2-3 | June-July | Mid Nov | Dec - Mar | Early Apr |
| ***Pseudotsuga menziesii*** Douglas Fir | 30-35 | 50-60 | 4-6 | May - Mid June | End Aug | Sept | Early Oct |
| ***Thuja plicata*** Western Red Cedar | 20-25 | 40-60 | 2-3 | May-June | End Aug | Sept | Early Oct |
| ***Tsuga heterophylla*** Western Hemlock | 30-35 | 40-60 | 3-5 | June | End Aug | Sept | Early Oct |

*Notes: Pinus spp cones develop over 1.5 years*

| | Collectable mature seed bearing trees per hectare | | Volume of cones per tree (hl) | | Volume of cones per hectare | | Yield of seed (kg) from one hectare | | Collection potential (hl per man day) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Average Crop | Heavy Crop | Average Crop | Heavy Crop | Average Crop | Heavy Crop | Average Crop | Heavy Crop | Felled Trees | Climbing |
| | 30 | 60 | 0.2-0.7 | 0.3-0.9 | 6-20 | 25-70 | 18-110 | 75-385 | 8-12 | 1.5-5 |
| | 20 | 60 | 0.2-1.5 | 0.3-3.0 | 6-30 | 25-100 | 20-150 | 100-500 | 10-15 | 2-8 |
| | 20 | 80 | 0.1-0.5 | 0.3-0.8 | 2-10 | 25-65 | 1.8-25 | 22-155 | 2-4 | 1-2 |
| | 20 | 80 | 0.1-0.5 | 0.3-0.8 | 2-10 | 25-65 | 1.8-12 | 22-80 | 2-4 | 1-2 |
| | 20 | 80 | 0.1-0.5 | 0.3-0.8 | 2-10 | 25-65 | 1.8-20 | 22-100 | 2-4 | 1-2 |
| | 20 | 60 | 0.3-0.7 | 0.3-0.9 | 6-15 | 18-55 | 6-25 | 18-85 | 8-10 | 2-3 |
| | 30 | 60 | 0.3-0.8 | 0.5-1.2 | 6-15 | 30-70 | 5-20 | 25-100 | 3-4 | 0.5-1.5 |
| | 30 | 60 | 0.01-0.05 | 0.03-0.08 | 0.2-1 | 2-4 | 1-10 | 10-30 | 1-3 | 0.5-2 |
| | 30 | 60 | 0.01-0.08 | 0.05-0.15 | 0.3-2.4 | 3-7.2 | 0.18-2.8 | 1.8-8.6 | 0.8-1.5 | 0.2-0.5 |
| | 10 | 50 | 0.05-0.4 | 0.1-0.8 | 0.5-4 | 5-25 | 0.2-4 | 2-25 | 3-6 | 2-3 |
| | 20 | 60 | 0.2-1.5 | 0.5-3.0 | 10-30 | 30-50 | ? | ? | 2-4 | 1-3 |
| | 20 | 60 | 0.2-1.0 | 0.5-2.0 | 2-5 | 10-15 | ? | ? | 2-4 | 1-3 |

*Applying the cut test to check a Sitka spruce cone for seed content and quality.*

Seed should be collected during the period between embryo maturation and seed dispersal, but usually as soon as it ripens on the tree. It is generally best to collect at the earliest opportunity after seed maturation as this is the time when maximum amount of seed is available. Any delay may result in the prospective harvest being lost. For most species, the exact timing of collection involves a subjective assessment using simple indicators such as attainment of "ripe" colouration of cones and fruit. However, most fruits and seed have a naturally wide variation in colour, size and appearance, which collectors can, with experience, come to recognise. Collections should only be made in dry weather as moist or damp cones are inclined to heat up and go mouldy, even during short-term temporary storage. Bags of cones must always be kept well ventilated and protected from the rain. Refer to Table 2 for guideline information. When in doubt about seed quality, it is always best to carry out a physical examination of the contents of cones 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).

## Cone Processing and Seed Extraction and Storage

On arrival at the processing plant, sacks of cones should be off-loaded as soon as possible and stacked in a well-ventilated open shed to allow any heat and sweating to dissipate. This storage is best in racking made of light poles, which will allow air to circulate around the sacks from all sides. Where vermin (e.g. squirrels and mice) are a nuisance, adequate protection must be put in place.

The ease of extracting seed from cones varies according to species. Cones of noble fir break up soon after collection. Western hemlock and Western red cedar cones can be opened by spreading them in shallow boxes or trays in a well-ventilated shed.
Cones of most other species are normally dried in a special seed kiln in which the temperature of the air is progressively raised as drying proceeds. After drying, the seeds are separated by shaking through coarse sieves or

*Drying cones in storage after collection, but before seed extraction has taken place.*

by rotating them in a wire-mesh drum, and then collected in a tray. Seeds with detachable wings are de-winged by gentle rubbing between cloth sheets or in a machine especially designed for the purpose. Wings, cone scales, empty seed and other impurities are separated from the seed by winnowing. The seed is then ready for testing for germination percentage, moisture content and storage. Seed can be satisfactorily stored in this condition until the following spring, provided it is kept cool, in sealed containers. However, seed for long term storage should be dried in warm dry air until the moisture content is between six and eight per cent. The dried seed should then be placed in airtight containers and stored in a cold store.

*Kiln used for extraction of seed from cones.*

*Removing cones from the kiln for extraction of seeds.*

*After extraction from cones, the seed should be dried and then stored in air-tight containers in a cold store.*

*Testing the quality of the extracted seed.*

## Additional Sources of Information


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