

Project number: 6274
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Project dates: Feb 2012 – Jan 2014

Progress in birch and alder tree improvement



Key external stakeholders:

Farm forest growers, tree nurseries, commercial forestry companies, COFORD & Forest Service, Department of Agriculture, Food and Fisheries

Practical implications for stakeholders:

Forestry is encouraged to bring Ireland in line with the EU average % forest cover and to provide future raw material for the forest processing sector. Broadleaf forestry is encouraged to diversify the growing stock and for ecological enhancement. The project is developing of a sustainable supply of improved, adapted and healthy seed of native birch and alder within the framework of the EU Forest Reproductive Material (FRM) regulations.

Main results:

- Downy birch and alder seed orchards were registered with the Forest Service as Qualified. The 'Qualified' status is two steps up from the basic wild material now in use.
- Clones of good silver birch from Scotland have been established here so that we can test to see if this material would be suitable for growing in Ireland.

Opportunity / Benefit:

The parent material will be available to nurseries to produce and market improved planting material. As the supply system is put in place, forestry owners can avail of improved material to increase the monetary and ecological value of their forests. The availability of improved birch planting material would enable the Forest Service to list birch as a grant-aided species providing more choice to forest owners.

Collaborating Institutions:

Teagasc project team: Dr. Elaine O' Connor
Oliver Sheridan

External collaborators:

1. Project background:

Two species of birch are native to Ireland; *Betula pubescens* and *Betula pendula*. Currently birch is not on the recommended species list for afforestation grants. Two factors have prevented the listing of birch as a recommended species; the poor stem quality of naturally regenerated birch and the poor survival and growth rates that has followed importation of seed from abroad. However, experience from abroad indicated that birch had improvement potential. The development of birch as commercial forestry tree species' supports government policy to increase forestry area, to increase the broadleaf component of forestry, to use more native species and to increase diversity in Irish forestry. As pioneer species, birch and alder are broadleaves suited to the types of land often put forward for forestry. They have a short rotation period, about 40 years, and improve the soil for the subsequent crop of trees. A disease outbreak, Chalara, has resulted in a ban on ash planting so there is a pressing requirement for alternative broadleaf species.

The birch project began with an initial study 'Pilot project for the genetic improvement of Irish Birch' (1998–2000). This has been followed by a series of other COFORD funding. The improvement of alder (*Alnus glutinosa*), a species that is on the Forest Service schedule, was initiated in 2005 and was tied in with the birch project to take advantage of similarities in the techniques of tree breeding. More recently, Feb 2012 – Jan 2014, the work was carried out within the FORGEN project.

2. Questions addressed by the project:

- Do better-quality provenances of birch and alder exist in Ireland and can they be recommended as suitable seed collection areas?
- Can superior individuals of birch and alder be identified to be used as a base population for an improvement programme?
- Do the characters of growth and stem form display heritability for cyclical and concurrent selection and improvement?
- Can superior families of birch and alder be identified in progeny trials, indicating high value parent trees to retain in the breeding populations?
- How do the selected clones respond to growing in a managed seed orchard and what is the annual seed yield?

3. The experimental studies:

The overall long-term objective of the research is the development of a sustainable supply of improved, adapted and healthy seed of birch and alder within the framework of the EU Forest Reproductive Material (FRM) regulations. This phase of the development involved;

- Establishing genebanks to preserve the genotypes;
- Establishing seed orchards;
- Establishing progeny trials to assess the value of the trees as parents.

The genebank and seed orchards are established using grafted clones. Scion wood is young vegetative growth, usually from the crown of the tree. For birch and alder, scion wood can be easily grafted onto seedling rootstock. The grafted clones allowed us to bring genetic copies of the superior trees back to the research station.

4. Main results:



- A genebank was established with a set of the grafted-clones to conserve the genotypes of the trees. This provides a backup if material is accidentally lost in the breeding population. It also provides a ready-made, well-described resource for other investigations into the species.
- Grafted-clones of alder plustrees were also used to establish a breeding population. A large polythene-covered house was used to establish an indoor seed orchard. This is designated as Qualified. It is planned to establish an outdoor alder orchard which will be easier to manage in the future
- For downy birch, seed was collected from the plustrees and planted out in three provenance/progeny trials. When these trials were ten years old another round of selection was applied. The best quality trees from the best performing families were grafted and used to establish an indoor Qualified downy birch seed orchard.
- To date, there has not been many silver birch of high quality found within Ireland on which to base an entirely native breeding population. This means that the development of a silver birch orchard is lagging behind the development of downy birch and alder orchards. To boost numbers we have received scion material from thirty-three plustrees from the Scotland. These Scottish plustrees originated from the best trees selected in stands of birch in an area bounded by the rivers Clyde, Forth, Mersey and Humber in the south Scotland/north England region. This is geographically and climatically close to Ireland. The hope is that we can take advantage of the selection of plustrees carried out by our Scottish colleagues but we have planted two silver birch trials to check that the population is adapted to Irish conditions and that the progeny will display the same better-quality characters when grown here in Ireland.

5. Opportunity/Benefit:

In the first instance parent material will be available to Teagasc, nurseries or a collaboration to upscale production and market improved planting material.

As the supply system is put in place, forestry owners can avail of improved material to increase the monetary and ecological value of their forests.

The availability of improved birch planting material would enable the Forest Service to list birch as a grant-aided species providing more choice to forest owners.

The collections provide a valuable resource for future breeding, molecular and physiology research and conservation.

There is very little information about birch growth in Ireland, in particular in a plantation situation. The progeny trials provide some information about birch growth in Ireland.

6. Dissemination:

Popular publications:

O' Connor, E. *Birch and Alder Qualified*. **2013** Science Spin Issue 60 p11
<http://www.sciencespin.com/magazine/archive/2013/09/>

O' Connor, E. *Birch and Alder – the development of a tree breeding programme and a seed supply for Irish forestry*. In Teagasc Technology Updates 2007–2012: A collection of 100 Technology Updates. **2012**
http://www.teagasc.ie/publications/2012/1596/Teagasc_Technology_Updates_2007-2012web.pdf

Oral presentations:

O' Connor, E and Sheridan, O. The distribution of alder plus-trees in Ireland and early results from progeny trials in the alder breeding programme. Irish Plant Scientists Meeting, National University of Galway **2013**

O' Connor, E. Update on the Irish Birch and Alder Improvement Programme. Presentation to the COFORD Board (Council for Forestry Research and Development) AGM **2013**

Posters

O' Connor, E., Sheridan, O. and McGuinness, B. Variation in response to pest and disease exposure in alder (*A. glutinosa*) progeny trials. IMPACT project final conference, Dublin **2013**

7. **Compiled by:** Dr. Elaine O' Connor