DEVELOPING SEED ORCHARDS FOR WILD CHERRY

Karen Russell describes how seed orchards are being created to produce native seed of known origin to improve wild cherry stocks.

S ince the late 1980s, Horticultural Research International (HRI) has undertaken farm woodlands and forestry research in a wide range of disciplines including breeding and genetics, establishment, propagation, physiology (plant and seed), and pests and diseases. The work has been carried out by researchers primarily at East Malling where research expertise and experience gained on fruit trees since the 1920s could readily be applied to forest tree research, but also at Efford and Wellesbourne. The research has focused largely on broadleaved trees, including both temperate and tropical species, and is funded by DEFRA, the EC, the Forestry Commission and charitable bodies.

Our research is currently split into five interdisciplinary themes:

- 1. Tree Genetic Resources including in-situ and ex-situ conservation and characterisation.
- 2. Forest & Woodland Biodiversity including habitat and biodiversity assessment, restoration, and creation and genetic diversity studies including geneflow.
- 3. Tree Breeding & Improvement involving conventional selection and crossing of parental material followed by selection and trialling of seedlings as well as the development and use of molecular markers through to commercial release.
- 4. Tree Propagation, Growth & Development including vegetative cuttings, grafting, micropropagation and seed propagation, physiology and mycorrhizae.
- 5. Pathology, Pests and Diseases including bacterial, fungal and viral pathogens, phytoplasmas, pests and integrated crop management strategy.

Current work on improving trees

Much of the improvement work on trees for farm woodlands and forestry has been undertaken by the Forestry Commission on conifers, particularly Sitka spruce. With the exception of poplar and willow for biomass production, the potential of broadleaf improvement has until recently been relatively neglected.

The British and Irish Hardwoods Improvement Programme (BIHIP), a forum for researchers and landowners working together on



Plus tree selected for seed orchard development.

Horticulture Research International

Horticulture Research International (HRI) is the single largest team of horticultural research and development scientists in the world with over 550 science and support staff. It is the principal UK organisation tasked with carrying out basic and strategic horticultural research and development and transferring the results to industry. Its customers include UK research councils, government departments, the EC, overseas agencies, growers, grower-funded levy bodies and the commercial industry.

HRI has five sites, the main ones being at Wellesbourne in Warwickshire, East Malling in Kent and Efford in Hampshire. Wellesbourne focuses on strategic science, annual crops and mushrooms, East Malling on fruit, hardy nursery stock, hops, farm woodlands and forestry, and Efford on protected crops, nursery stock and soft fruit. Each commodity has a research scientist appointed to provide the link between the science and industry. Karen Russell is the forestry commodity specialist, and is based at East Malling, Kent.

Further information can be found on the HRI website: http://www.hri.ac.uk

the improvement of broadleaf species, has encouraged tree improvement in ash, birch, chestnut, cherry, oak and walnut through research carried out by various institutes including the Oxford Forestry Institute, The Northmoor Trust, HRI, and the Forestry Commission. However, there is yet still much to be done. Each species has a working group that agrees the improvement approach and seeks the research funds to carry this work out. Further information can be obtained from the BIHIP website: http://bihip.com

The wild cherry programme at HRI

The development of grants to encourage the planting of woodlands on farmland in the late 1980's triggered DEFRA (formerly MAFF) to sponsor a series of improvement research projects at HRI East Malling. Our main objective has been to develop vigorous, welladapted trees with good form and pest and disease resistances suitable for farm woodland plantings. Increasingly, we need to ensure that these trees are environmentally acceptable, e.g. of local or native origin, where appropriate.

We chose to focus our efforts on wild cherry (Prunus avium L.) as it is one of the most attractive. native trees, which can grow on a wide variety of soil types and is particularly suited to lowland, ex-arable It also has the sites of being advantages unattractive to grey squirrels and fast growing, giving a quality hardwood timber after about 70 years that is in demand for furniture making and able to substitute for tropical hardwoods. In addition. HRI could apply its extensive experience on the genetic improvement of sweet cherry. the domesticated form of wild

cherry, to the wild cherry programme, enabling rapid progress.

The wild cherry improvement programme started in 1988 and was described by Fiona Nicoll in *QJF* (Nicoll, 1993). At the time, wild cherry did not have a very good reputation, as many trees were raised from imported seed and were of unknown origin or quality; many were probably of sweet cherry type. As a result, the adaptability of these trees to UK conditions was often very poor, with many dying from canker or forming poor trees. The programme at HRI sought to provide genetically reliable material of known UK origin to the UK nurseries.

To achieve this we have used the following approach. The first step is to identify superior trees found in our ancient and semi-ancient woodlands across the UK. Once identified, the graftwood is collected during the winter months by using a long-armed pruning saw or a climber. The graftwood is then taken back to East Malling where it is propagated by grafting on to rootstocks, thereby enabling its conservation for use in the breeding programme. These young grafted trees are then tested for various viruses using herbaceous indicator plants (cucumber and henbane). Any trees indicating virus symptoms were rejected at this stage to prevent the spread of viruses and their detrimental effects in the programme. Typically about 5% of the trees collected were found to contain viruses. The healthy trees, about 100 accessions in all from 1989 to 2002, are being used in three ways:

- 1. They are propagated vegetatively by micropropagation for multisite trials with a view to choosing the best selections for commercial release. This approach, simple and straightforward, is the one we used to create the Wildstar[™] collection, the UK's first ten wild cherry clones that we released in 2000. www.hri.ac.uk/wildstar.
- 2. The second is to create seed orchards, where good accessions are grafted on to rootstocks. The trees of several accessions are planted out to cross-pollinate each other to produce native seed of known origin and, we hope, of reasonable quality.
- 3. The third approach, long term but with the greatest potential benefits, is to select individual trees with desirable characters and to cross pollinate them, with the aim of combining these characters in the seedlings. The seedlings are then selected and the most promising are propagated clonally and trialled to identify the best for commercial release.

These approaches provide material which is suitable for different circumstances, e.g. clones will be desirable for commercial plantings and seedling material for planting in ancient woodlands.

The rest of this article focuses on the development and creation of wild cherry seed orchards.

Seed orchards

Wild cherry is typically found in woodland growing in small groups or as individual trees. As it frequently reproduces clonally by suckers, the genetic diversity found within a stand is often low, as few of the individuals are genetically distinct.

Stands of good quality with more then 30 genetically distinct individuals in the UK are very scarce. This, plus predation of seed by birds and mammals, makes the collection of seed from quality stands very difficult and it is seldom undertaken. The propagation of trees to create UK seed orchards overcomes these problems and has the additional advantages that the source of the seed and the quality of the parents are known, and dependency on foreign imports is avoided. So far, one seed orchard is producing seed, another has been planted and a third is planned.

Our first seed orchard comprised 17 clones which I'll describe in a moment. These were propagated by budding on to Tabel®-Edabriz rootstocks, a French, Prunus cerasus rootstock, by Blackmoors Nursery, Liss, Hampshire in August 1997. Tabel[®] rootstocks were used, as they not only reduce the vigour of the trees by up to 60% compared to P. avium rootstocks, thereby making the trees easy to net against birds to reduce seed losses, but they also induce very good precocity and productivity. The seed orchard was planted at the nursery of Woodland Improvement & Conservation Limited (WIC Ltd.), Gloucestershire in May 1998. In total, 290 trees were planted at 4m apart in rows and at 5m between rows, and on average, there were 15 trees of each clone.

Cherry is self-incompatible, i.e. self pollen cannot set fruit. A laboratory technique developed at East Malling was used to determine the incompatibility group of each clone. Using this information, the seed orchard was carefully designed so that each tree was surrounded by neighbouring trees with which it was fully compatible to maximise the chance of pollination and therefore, fruit set. Seeds were first collected from the orchard in 2000 and are now collected each year, contributing to the provision of native genuine wild cherry seedlings to the UK industry. The resulting seedlings are raised and sold by WIC Ltd.

Clones 1 to 4 (Accession numbers 1904, 1909, 1912 and 1919 respectively) were chosen for their good vigour and form in the wild. They were selected by Drs Neil Hammatt and Fiona Nicoll from the first 17 clones collected between



Propagation of cherry trees for seed orchard.

1989 and 1992 from woodlands in Oxfordshire, Powys, Cumbria and Buckinghamshire respectively. All are in multisite trials and clones 1 and 3 have been used in the breeding programme.

Clones 5 and 6 (Seedling numbers F12/1 (wild seedling from a seedlot in 1917) and FD1-57-4/13 (seedling of F1/3a) respectively) were selected by East Malling many years ago for vigour and bacterial canker resistance. Both are performing well in clonal trials and have been used as parents in the breeding programme. Clones 1 to 6 have also been selected as WildstarTM clones.

Clones 7 to 15 (Accession numbers 2916, 2971, 2973, 3177, 3185, 3183, 3180, 3179 and 3181 respectively) were selected by Karen Russell as the best of 9 out of 20 clones of wild cherry collected by her from 14 woodlands in Kent, Suffolk, Gloucestershire, East Sussex, Hampshire and Nottinghamshire in the period 1994-96. These are currently being evaluated for bacterial canker resistance, vigour and form and all are in trials except clones 11 and 13.

Clones 16 (Accession number 3156) from Leicestershire and 17 (Accession number 2884) from Yorkshire are recorded by the Tree Register of the British Isles as the largest and widest (respectively) wild cherry trees in the British Isles. These are not in trials.

A second seed orchard of 20 clones (Accession numbers 5005, 3181, 1922, 3146, 3180, 3537, 2916, 1918, 5022, 3185, 2474, 1919, 3183, 1902, 5009, 1921, 5010, 5007, 1904 and

3543 respectively) collected from the Forestry Commission Zone 405 (South East England), was propagated on to a German rootstock called Gisela 5 (a hybrid of *P. cerasus* x *P. canescens*) in March 2001 at HRI East Malling to create the first regional wild cherry seed orchard.

The Gisela rootstock was used as it is more dwarfing than Tabel[®] allowing a more intensive planting and the trees are spaced at 2.5m in the row. The clones were collected from woodlands in Buckinghamshire, East Sussex, Essex, Hertfordshire, Kent, Oxfordshire and Surrey and have been chosen for their good vigour and form.

As the emphasis was on providing trees on a regional basis, only five are in clonal trials. Again, the incompatibility genotypes of these clones were established and these were taken into account when designing the planting so that all adjacent trees were cross-compatible, which should help maximise seed set. The seed orchard was planted at HRI East Malling in March 2002 and should be producing seed in increasing quantities from 2004 onwards. If you are interested in seed from this orchard, please contact Karen Russell at East Malling.

Twenty clones from Forestry Commission Region 30 (South West England, Wales and North West England) have been identified with a view to establishing a western local seed orchard in 2002/03.

These seed orchards will provide good, native and local planting stock which will complement the other plant material coming from East Malling's breeding programme. It is planned that, in the future, regional, clonal seed orchards will be developed for other important broadleaf species such as oak, sweet chestnut, ash and walnut in association with BIHIP. If you know of any potential plus trees of these species, please contact me at the address below.

REFERENCES

Nicoll, F. (1993) *Quarterly Journal of Forestry*, **87**, No.3, 187-194.

Karen Russell is the forestry commodity specialist at Horticulture Research International, East Malling, West Malling, Kent ME19 6BJ.