

The roles of tree breeding and silviculture in disease control

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INTRODUCTION

Tree improvement involves the breeding and selection of traits/genes to improve quality

Silviculture is the art and science of cultivating tree crops

Both contribute to creating and maintaining healthy and valuable forests and have essential roles to play in disease control

Genotype + Environment = Phenotype



TREE IMPROVEMENT STRATEGY

To produce trees with:

- Rapid growth
- Good form - straight stem and wide, light branching
- Resistance to pests and diseases
- Environmentally acceptable

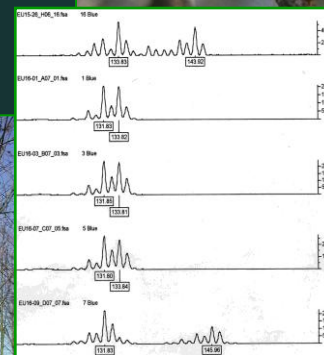
At reasonable cost whilst maintaining sufficient genetic variation to ensure future gains



BREEDING FOR RESISTANCE

Requires:

- Understanding of the pathogen
- Availability and testing of breeding collection including closely related species
- Identification of 'resistant' species and individuals using conventional and molecular techniques
- Controlled crossing of resistant individuals with individual with good form and vigour
- Testing of offspring
- Continued breeding and genetic studies to produce good quality trees with robust resistance



WHEN TO USE BREEDING APPROACHES

Where sufficiently high heritability values (>0.25) for disease resistance are present, then breeding approaches to address diseases can be feasible.

Examples include for:

1. Intraspecific resistance (within species):
2. Interspecific resistance (hybridisation between species)
 - *Phytophthora* resistance in chestnut, walnut, apple, pear and cherry
 - Leaf spot (*Blumeriella jaapii*) resistance in cherry



BENEFITS & LIMITATIONS

Benefits

- **Characterisation and increase in the availability of resistant plants**
- **Aids commercial viability while maintaining amenity and conservation values**
- **Encourages better silviculture**
- **Improved confidence in planting stock encourages further tree planting**

Limitations

- **Long time scales and costs involved**
- **Lack of multidisciplinary collaboration**
- **Increasing number of pathogens**
- **Limited plant material, resources and skills base**
- **Inconsistent long term policy support and finance**

SILVICULTURE

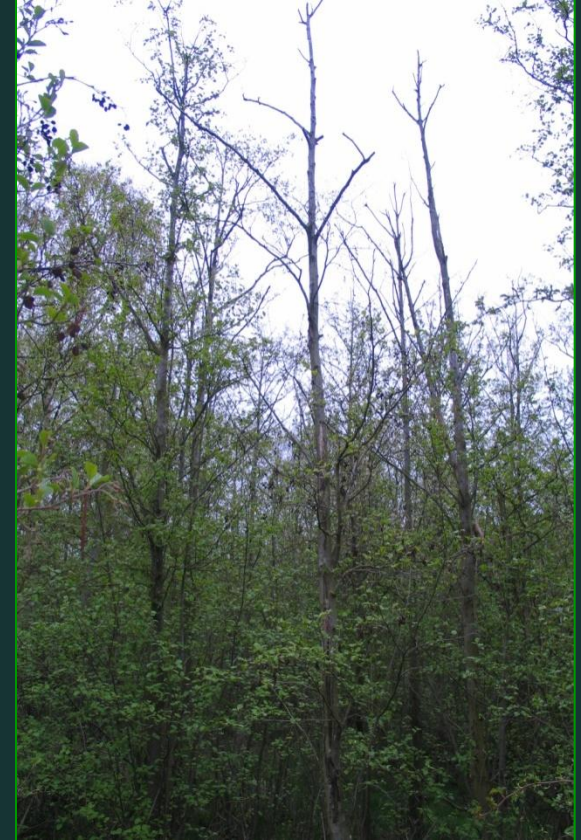
Relatively few pests and diseases attack healthy trees successfully, therefore:

- Maintain well-adapted, healthy trees. Trees that are or have been under stress are much more susceptible to damage
- Damaging pathogens are most prevalent in seedling and senescent phases
- Seedlings in forest nurseries tend to need more protection than older trees



FACTORS THAT STRESS TREES

- Climatic stresses mainly due to drought and freezing
- Poor nutrition
- Water logging
- Wind
- Lack of light due to under thinning
- High humidity due to under thinning
- Toxic gases associated with pollution



WAYS OF MAINTAINING VIGOUR IN TREES

- **Careful selection of species**
- **Buy seed and plants from reputable sources**
- **Use the correct provenance for the site**
- **Maximise genetic diversity in trees planted**
- **Control weeds in young plantations**
- **Timely thinning**
- **Control deer and grey squirrels**
- **Hygiene, e.g. with thinning and pruning**

SUMMARY

Tree improvement gains can only be maximised when combined with good silviculture which is central to maintaining healthy forests.

- **Use appropriate planting stock and mixtures**
- **Plan carefully**
- **Plant carefully**
- **Be diligent with aftercare and aware of pests and diseases**
- **Seek assistance/advice on the control of pests and diseases should they occur**

FURTHER INFORMATION

Our paper '**The roles of tree breeding and silviculture in disease control**' is due out in the July issue of the *Quarterly Journal of Forestry*

