TESTING POPLARS AND WILLOWS FOR SHELTER BELTS

M.S. VAN REENEN and A.G. WILKINSON

National Plant Materials Centre
Aokautere Science Centre
Ministry of Works and Development
Palmerston North, New Zealand

The National Plant Materials Centre is part of the Aokautere Science Centre, Ministry of Works and Development, Palmerston North. It is responsible to the National Water and Soil Conservation Organisation for the breeding and selection of plants suitable for erosion control in rural and urban situations. Many plant genera are currently being imported and several of these possess clones or species with characteristics suitable for farm or horticultural shelter. The two genera with which the Centre has had the most experience to date are *Populus* and *Salix*.

POPULUS

Poplars were represented in New Zealand prior to 1973 mainly by the widely planted silver poplar (*P. alba*), cottonwood (*P. deltoides*) and the fastigiate Lombardy poplar (*P. nigra* 'Italica'). Several *P* × *canadensis* (*P.* × *euramericana*) poplars were also planted in an increasing extent for erosion control, and a semi-evergreen mutant of Lombardy poplar, *P. nigra* 'Sempervirens' was widely used for horticultural shelter. The semi-evergreen Lombardy poplar comprised the bulk of shelterbelts in the Tauranga — Te Puke area and a high proportion of shelterbelts in the other horticultural districts.

Since the poplar leaf rust *Melampsora larici-populina* was discovered in New Zealand in 1973 it has overwintered on the semi-evergreen Lombardy poplar and spread rapidly throughout nursery shelterbelts each spring causing premature defoliation.

This has led to reduced growth, dieback of branches, and death of many semi-evergreen Lombardy poplar shelterbelts, as well as providing a source of inoculum for infection of other fully deciduous poplar clones in the vicinity.

The heavy and early rust attacks on poplars planted for soil conservation have been mainly due to the widespread distribution of the semi-evergreen Lombardy poplar; for this reason this Centre continues to recommend the removal of all plants of this clone.

The ordinary Lombardy poplar is also highly susceptible to this leaf rust but has suffered to a lesser extent. The only areas

where the rust is of little importance are the inland areas of Otago and the central South Island, and parts of the Wairarapa where summer rainfall and humidity are low.

The two fastigiate Lombardy poplar clones have been popular because they provided fast efficient shelter when grown from woody unrooted stem cuttings. Their crown is narrow requiring less trimming and occupying less area than most other shelterbelt species and they are mainly free from pests and diseases of fruit tree crops.

In 1976 a new poplar leafspot disease caused by the fungus *Marssonina brunnea* appeared in the Manawatu area. This disease can cause premature defoliation of susceptible poplar clones. Laboratory tests have shown that both kinds of Lombardy poplar are highly susceptible to this disease.

Although *Marssonina* is at present found only in the Manawatu district it may spread further during the next few years. The Lombardy poplar should only be used for horticultural shelter if a regular spray schedule to control *Melampsora* and *Marssonina* can be carried out.

Another fastigiate poplar clone used occasionally for shelterbelts is the rust- and *Marssonina*-resistant 'Bolleana poplar', *P. alba* var. *pyramidalis*. It is slower growing than the Lombardy poplar but free from poplar diseases and pests and may be more tolerant of salt spray. The chief disadvantage of this clone is its tendency to form root suckers. This has been partially overcome in the past by grafting onto *P. yunnanensis* rootstocks. Further work is needed on identifying compatible non-suckering rootstocks before this clone can be recommended for horticultural shelter.

New poplars for horticultural shelter: A rust- and *Marssonina*-resistant *P.* × *canadensis* (*P.* × *euramericana*) clone 'Flevo' was released in 1974/1975 and a rust, *Marssonina* and opossum-resistant clone of *Populus trichocarpa* 'S61741' will be released to commercial nurseries in 1979. Both of these clones should be used only for perimeter shelterbelts around orchards or nurseries since they have large wide-spreading crowns.

The fastigiate Lombardy poplar clones used in New Zealand have widely demonstrated wind resistance and suitability for horticultural shelter.

The fastigiate form of *P. nigra* occurs naturally in the Middle East and, in 1976, a study tour was carried out by C.W.S. van Kraayenoord to locate clones currently used for shelter in western Europe and to select seed sources for importation into New Zealand. As a result of this tour ten seedlots of fastigiate *P. nigra* were imported from Turkey and a total of 33 narrow-

crowned clones of *P. nigra* were imported from Italy, Turkey, France and Yugoslavia. Rust-resistance tests have so far been disappointing since all clones and seedlings have proven susceptible to *Melampsora larici-populina*. Two of these imported clones and 35 of the seedlings have been selected for low to medium susceptibility to rust and are currently undergoing further resistance tests for rust and *Marssonina*. If they do not prove sufficiently resistant then additional seedlots may have to be imported or disease resistance bred into hybrid clones with this form.

Overseas breeding experience indicates that the fastigiate form can be transmitted in varying degrees to a reasonable percentage of hybrid seedlings. Some preliminary hybridisations were made in August, 1978, between rust- and *Marssonina*-resistant *P. deltoides* clones and the rust- and *Marssonina*-susceptible, *P. nigra* 'Italica'. This may provide a range of disease resistant hybrids, some of which may also possess narrow crown forms. The selection of suitable clones from these hybrids will take a minimum of three years in the nursery, followed by three years of field trials.

Poplars for farm shelter. Many less fastigiate poplar clones of a variety of species have been selected for disease resistance at the National Plant Materials Centre and are at present undergoing comparative growth tests at a number of nursery and field locations throughout New Zealand. Many of these clones will be suitable for farm shelterbelts. The first of these clones will become available during the early 1980's

Several disease-resistant clones of *P. trichocarpa* appear particularly promising. These clones were selected from seedlots imported from California in 1974. They possess fine flexible branching over the whole stem and have small leaves which are highly unpalatable to opossums. Their resistance to rust is excellent. Resistance to *Marssonina* is good but further observation is necessary to confirm the level of resistance of each clone.

The first nursery and farm shelterbelt trials of these clones were established in winter, 1978, and additional test plantings are planned for 1979.

Observations of adult trees in California indicate that these clones will have a broad-crowned adult form similar to *P. deltoides* 'Frimley', the common cottonwood clone in New Zealand.

SALIX

Although willows are used extensively in shelter planting in Europe and North America they have not been used much for

this purpose in New Zealand, mainly because the types commonly available were not suitable. The crack willow (*Salix fragilis*) and the weeping willow (*Salix babylonica*) have too broad a crown and are not very wind firm. However, several willows are useful shelter species particularly for wetter sites. As tree willow roots do not spread as far as poplar roots they compete less with crops. Neither do they form suckers from the roots.

The osiers and shrub willows which can be maintained as quite dense shelter by regular trimming are suitable for small to medium-sized shelter. They can be planted in single row shelter belts. These lower growing willows are also suitable fillers in shelterbelts of tall-growing narrow-crowned broadleaved species. However, as they are light-demanding species they must have room to grow upward otherwise they will spread laterally towards the light. They are unsuitable for underplanting with conifers as they will not tolerate shade.

The use of willows in shelterbelts in the past has been restricted to the use of the common pussy willow (*Salix discolor*, or *S. caprea*). These species have disadvantages in that they act as a host for red spider mites and San Jose scale. They are wider spreading and slower growing than Lombardy poplar. The profuse crops of male flowers in spring strongly attract bees and are reputed to result in reduced pollination and fruit set on orchard trees nearest to the shelterbelt. Although these species possess these disadvantages they are still one of the cheapest and most effective shelterbelt trees currently available. The best examples of shelterbelts of these species can be found in Hawkes Bay where they have been widely used.

Several shrub willow hybrids including *S. discolor* hybrids have been established in nursery shelterbelts at the Aokautere Science Centre.

Since 1973, the tree willow, *Salix matsudana* (Peking willow) has been recommended as an interim alternative to Lombardy poplar. It has a very rapid growth rate growing up to 15 meters tall and can give good quick shelter until slower growing species (such as *Cryptomeria japonica*) are sufficiently large for the willow to be removed. It is free from most pests and diseases of fruit trees, but is highly susceptible to silverleaf disease (*Stereum purpureum*). It has not been grown as a trimmed shelterbelt previously and thus it is not known how well the clone will stand up to regular trimming.

Hybrid clones from the cross *S. matsudana* × *S. alba* (white willow) are also under test at present for soil conservation planting. These are extremely vigorous and there are several clones with a narrow growth habit which could be used.

These clones were established in nursery shelterbelts in winter 1977 and require further testing before release.

One hybrid clone, 'NZ 1002' was released in 1978, and can be used in place of *S. matsudana* because it has a greater early growth rate.

All of these tree willow clones are likely to lose their lower branchs and should be underplanted with low-growing willows or shrubs. Alternatively these can be planted in a row in front.

Salix chilensis (Syn: *S. humboldtiana*) var *pyramidalis*, the only willow native to South America, has been used recently for orchard shelter because of its fastigiate, semi-evergreen habit. In shelterbelts at the National Plant Materials Centre, the clone has proved disappointing.

The branches also die back when subjected to frosts or salt-laden winds, and the whole plant may die back when transplanted as a rooted plant. The root system is weak and the plant is subject to toppling on sites with a high water table or shallow soil profile. This clone may be acceptable in warmer areas not subject to frost or salt-laden winds but should only be considered for temporary shelter of up to five years duration.

OTHER SPECIES

A shelterbelt project has been started to look at genera and species suitable for the prevention of wind erosion of topsoil from farmland. It is intended to examine closely species already available in New Zealand and to introduce new plant materials as necessary.

The Aokautere Science Centre has recently established shelterbelts of various species and clones of *Alnus*, *Betula*, *Casuarina*, *Eucalyptus*, *Tamarix*, *Olearia* and Leyland cypress for nursery shelter. It will be several years before these belts have been adequately tested but at present the Leyland cypress clones to not appear very promising due to the occurrance of toppling, and of cypress canker caused by *Monochaetia*. They also have a wide-spreading habit requiring regular trimming.

SUMMARY

The National Plant Materials Centre has selected and released several rust-resistant poplar clones which appear promising for shelter. These clones are, at present, being tested in the Centre's nursery and will be tested in farm shelterbelts from winter, 1978.

Fastigiate forms of *Populus nigra* similar to the Lombardy poplar *P. nigra* cv. Italica have been imported as seed and cuttings and tested for rust-resistance. Several clones are less rust-

susceptible than Lombardy poplar but need further testing for *Marssonina* resistance. The Lombardy poplar is being hybridised with rust-resistant *Populus deltoides* clones in an attempt to combine the fastigiate character with high rust-resistance.

A new tree willow hybrid, *Salix matsudana* × *S. alba* cl. 'NZ 1002', has been released and other tree willow hybrids are being tested in shelterbelts at the Centre.

Hybrids of the common 'pussy willow' *Salix discolor*' and other shrub willows have also been established in shelterbelts at the Centre.

Other genera established for shelter include, *Alnus*, *Betula*, *Casuarina*, *Eucalyptus*, *Tamarix* and *Olearia*. Many more genera are being tested for erosion control and any which appear to have promise for farm or horticultural shelter are retained and tested for this purpose.

RAPID PROPAGATION OF ASPENS AND SILVER POPLARS USING TISSUE CULTURE TECHNIQUES

C. B. CHRISTIE

National Plant Materials Centre
Aokautere Science Centre
Ministry of Works and Development
Palmerston North, New Zealand

In New Zealand poplars are extensively used for soil conservation, farm forestry and for orchard shelter. In 1972 nearly 1 million poplars were planted.

In 1973, however, two species of poplar rust, *Melampsora medusae* and *M. larici-populina* became established in New Zealand. These fungi cause severe premature defoliation, which can result in branch dieback and even in death of the very susceptible poplar clones. Many of the most common poplar clones were affected and their continued cultivation became impossible. As a result poplar planting decreased dramatically in the following years until the first resistant clones selected by the National Plant Materials Centre (now part of the Aokautere Science Centre) became available in 1976.

It also had become apparent that a small number of the existing poplar clones were resistant to the rusts, notably *Populus alba* (silver poplar), *P. tremula* (European aspen), and *P. tremuloides* (American aspen). These poplars, besides being disease resistant, also possess a suckering habit making them valuable in soil conservation planting. However, the aspen pop-