

AgR Land & Environmental Management

Poplar Clonal Trials – Henley & Lawrence

Programme Contract C06X00041

Objective 3: Sustaining Soil - Production and Protection

Assessment Report to April 2003

Executive Summary

- Poplar clonal trials at Henley (planted 1986) and Lawrence (planted 1990, 1991) were assessed in spring 2002 and autumn 2003. The past summer season has been unusually dry for coastal Otago.
- Diameter breast height (DBH) measurements were compared to those taken in 1999 and an analysis of variance was conducted on that data.
- At Henley, *P. deltoides x nigra* clones (800 series) had a growth increment of ± 80 mm. Eridano (PN 850) and Flevo (PN 462) were among the higher DBH trees but Veronese (PN870) and Tasman (PN 559) were only average in terms of growth potential.
- Clones with best vigour and form at Henley included 800 08/02 and 08/07, 800 18/07, 800 33/87, 33/36 and 33/79, and 800 02/33. Tasman and Veronese were also in this group but had lower DBH's.
- At Lawrence the *P. deltoides x nigra* clone 800 08/9, Eridano (PN 850) and Flevo (PN 462) had best growth potential with increments of ± 90 mm (1990 planting) and ± 130 mm (1991 planting). However, Eridano had a high mortality rate and tree form was only medium.
- Clones with best vigour and form at Lawrence included Flevo, 800 08/09, 821 77/2 and 821 79/6 in the 1990 plantings, and the *P. deltoides x ciliata* clones 830 11/15, 830 17/1 and 17/23, 830 20/1, 830 26/12, and *P. deltoides x maximowiczii* 830 43/1 and 43/7 from the 1991 plantings. Tasman and Veronese had good form but lower DBH's.
- Tree height and DBH increments for Henley were about 60% of those for the 1991 Lawrence trees. Tree heights were similar to those of the 1990 Lawrence trees but DBH's were about 20% lower. Other than differences in tree age, the reason(s) for this slower growth rate are not immediately apparent.
- At both sites earliest spring growth was recorded for Flevo, Tasman, Eridano, Veronese and the clones 800 08/09, 821 71/07 and 73/01, 830 11/32 and 26/14. Slowest bud break was noted for Kawa, Yeogi 1, Crowsnest, several 800 15/- lines and 821 52/08.
- Earliest autumn senescence was noted for Flevo, Yeogi 1, 800 08/09, 821 52/08 and 830 27/03. Late senescing poplars included Kawa, Veronese, PN 5007, 821 79/10 and 830 26/14.

A. Background – Site and Environment

This report relates to Bullet Point 2: Continued monitoring of previously established trials (of older clonal material).

Poplar clonal trials were originally established at Henley (J. Adams property) in 1986, and at Lawrence (W. McNeish property) in 1990/91. Planting and later management/monitoring were largely carried out by the then MWD, Water and Soil Division, and the Otago Catchment Board.

The Henley site (NZMS 260, I45:925674) is on a moderately steep north facing slope that has had a history of slipping and slumping. Altitude is about 80m asl. The Lawrence site (NZMS 260, G44:501733) is on an easy sloping southerly aspect, again with a history of slipping and slumping. Altitude is about 140m asl.

Both sites are coastal and normally have good rainfall. However, this past summer has been extremely dry (Table 1). Poplars at the Henley site were pruned to 6-8 m during late summer to provide stock fodder due to lack of pasture growth under drought conditions. Those at Lawrence were not required for supplementary forage, but pasture growth has been minimal since December and soils are presently extremely dry and cracked. Some trees senesced early because of the drought, considered by the farmer to be the worst he has seen in 20 years.

Table 1. Monthly Rainfall (mm) at Ettrick, Lawrence and Dunedin Airport, August 2002 to April 2003.

Month	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Site									
Ettrick	55	43	40	37	31	42	37	7	18
Lawrence	50	39	48	77	41	62	43	14	23
Dn Airport	45	32	50	63	40	65	60	12	25

Heavy snow occurred during winter 2002 and strong (predominantly NW) winds were experienced during spring/summer, resulting in branch damage and breakage to a number of trees.

B. Methods:

The Lawrence site was first assessed in May 1999 with a subsequent assessment during bud break in September 1999. An equivalent assessment was made at Henley in September 1999. Data and reports on this work were forwarded to Hort Research at the time.

The current assessments at Lawrence and Henley were conducted during bud break (10th and 21st October, 2002 respectively), and again in April 2003 (9th April for Henley, 30th April for Lawrence). In spring 2002, parameters assessed included ranking (0 = minimum to 2 = maximum) for bud break and leaf density, and phenology including leaf colour and catkin presence.

In autumn 2003 the following parameters were assessed: Vigour ranked 0-5(=maximum); Tree Height (selected clones only, m), Diameter Breast Height (DBH, cm); Bark Roughness, Leaf Density and Tree Form (0-2 ranking as above); and phenology including leaf colour, senescence, wind and frost damage.

Primary emphasis was given to tree DBH as a means of comparing growth between the clones over the four year period. DBH data were collated for each site/trial and subjected to an analysis of variation (Genstat, R. Littlejohn, Invermay). Tree height was measured on selected tree pairs, generally the better growing ones. At Henley many large high pruned branches littered the site, and the tree height/canopy cover made it difficult to accurately sight tree tips and run the measuring tape out whilst working alone. Apart from the prunings, similar problems were encountered at Lawrence.

Results

C. Henley Poplar Clones

Data (DBH) for the poplar clones at Henley are presented in Table 2. *P. deltoides x nigra* clones (800 series) dominated in terms of growth with the better clones having growth increments of 75-100 mm. Eridano (PN 850) and Flevo (PN 462) were the only named clones among the higher DBH trees. Veronese (PN870), and to a lesser extent Tasman (PN 559), were only average in terms of growth potential at Henley but variability there, as reflected in the SED, was quite high in comparison to that for Lawrence.

Other parameters such as vigour and tree form are also important in determining suitable clonal material for breeding programmes and poplar varietal releases. Clones that recorded high vigour and consistently good form at the autumn assessment are also indicated in Table 2. Those with good vigour/form and greater growth included 800 08/02 and 08/07, 800 18/07, 800 33/87, 33/36 and 33/79, and 800 02/33. Tasman and Veronese were also in this group but, as noted, had lower DBH growth. Eridano recorded below average tree form and 800 08/09 had medium tree form at this site.

Table 2. Mean poplar clonal DBH and incremental growth increases (mm) for Henley, 1999 to 2003, in decreasing order of growth increment. Vigour/form are indicated as G = good, M = medium, B = below average.

Clone Code	1999	2003	Increment	Vigour/Form
800 08/09	222.0	322.0	100.0	M
PN 850 Eridano	131.9	216.9	85.0	B
800 08/02	199.0	279.0	80.0	G
PN 462 Flevo	225.5	305.5	80.0	M
800 33/92	180.5	260.5	80.0	M
800 15/31	186.5	265.5	78.9	B
800 18/07	237.6	315.6	78.0	G
800 15/33	149.8	227.8	78.0	B
800 08/07	199.0	275.7	76.7	G
800 33/87	206.9	283.1	76.3	G
800 02/33	221.0	296.0	75.0	G
800 33/36	207.3	281.7	74.5	G
800 07/86	211.3	285.7	74.5	M
800 15/57	194.4	268.7	74.3	M
800 14/14	187.1	261.4	74.3	M
800 15/55	181.9	254.1	72.2	M
800 33/79	207.0	278.0	71.0	G
800 14/141	196.4	266.4	70.0	M
PN 559 Tasman	213.3	283.3	70.0	G
800 29/104	172.1	240.9	68.8	G
800 08/05	209.6	278.4	68.8	M
800 02/38	205.6	273.4	67.8	G
800 15/34	189.1	256.3	67.1	B
800 02/23	231.8	296.2	64.5	G
800 29/05	199.1	262.9	63.8	M
800 02/36	151.1	214.9	63.8	M
800 24/04	183.4	244.6	61.3	B
800 29/96	192.8	252.8	60.0	M
800 15/20	173.6	233.6	60.0	M
PN 870 Veronese	194.7	251.0	56.3	G
800 29/04	195.2	250.8	55.6	G
800 14/11	171.8	226.1	54.3	M
800 15/39	240.5	280.5	40.0	M
800 15/58	157.3	197.3	40.0	B

SED DBH (Clone & Year) = 25.9 P<0.001

SED (Clone) = 6.5 P<0.001

Spring 2002 Assessment

At the October 2002 assessment, Flevo (PN462) was consistently the earliest clone to develop, recording a high ranking for both bud break and leaf density. Most other named clones also developed early (eg Tasman, Eridano, Veronese), with 800 08/09 being foremost in the 800 series. Conversely, the slowest clones to develop in spring were the 800 15 lines (15/31 and 15/33 in particular, also 15/20, 15/57 and 15/58). Other slow developing lines were 800 08/05, 800 14/11 and 800 24/04.

Catkins were most apparent on 800 08/07 and 800 29/104 during spring, with 800 14/11 also having a good number. They were least prevalent in the 800 15 series (particularly 15/20, 15/34, 15/39, 15/55 and 15/57) along with 800 07/86, 800 08/05, 800 14/141, 800 24/04, 800 29/04 and 29/05, 800 33/36, Flevo and Tasman.

Leaf colour varied markedly. Strong bronze-green colour was noted in 800 08/05 and 08/07, 800 24/04 and 800 33/36. Tasman, Flevo and Veronese all had dark green foliage, along with 800 02/38, 800 09/09 and 800 14/141. Light green foliage was noted in 800 15/20 and 15/58, and 800 29/05

Autumn 2003 Assessment

Only a few trees at Henley had started to senesce with lighter leaf colours. Most still had green leaves with the following clones being dark green: Veronese, Flevo, 800 08/02 and 08/05, 800 15/31, 800 24/04, 800 29/05, 800 33/96.

Degree of bark roughness was as follows: clones with greatest roughness included Tasman, 800 07/86, 800 08/09, 800 33/87 and 33/92. Smoother barked clones included 800 29/05 and 800 14/11.

D: Lawrence Poplar Clones

Data (DBH) for the poplar clones at Lawrence are presented in Table 3. As at Henley, the *P. deltoides x nigra* clone 800 08/9, Eridano (PN 850) and Flevo (PN 462) were dominant in terms of growth potential. Growth increments for the better clones were about 90 mm (1990 planting) and about 130 mm (1991 planting). Eridano had a high mortality rate, tree form was only medium and it was early both to break bud and to enter senescence.

Clones with best vigour/form and growth (Table 3) included Flevo, 800 08/09 and 821 77/2, 821 79/6 in the 1990 plantings, and the *P. deltoides x ciliata* clones 830 11/15, 830 17/1 and 17/23, 830 20/1, 830 26/12, and *P. deltoides x maximowiczii* 830 43/1 and 43/7 from the 1991 plantings. As noted above, Eridano had good growth, but only medium form (cf. below average at Henley). While their form was good, Tasman and Veronese remained in the mid- to lower DBH growth range.

Table 3. Mean poplar clonal DBH and incremental growth increases (mm) for Lawrence, 1999 to 2003, in decreasing order of growth increment. Vigour/form are indicated as G = good, M = medium, B = below average.

A.. 1990 Plantings

Clone Code	1999	2003	Increment	Vigour/Form
PN 462 Flevo	241.7	333.3	91.6	G
800 08/09	257.5	347.0	89.5	G
821 77/02	247.2	336.0	88.8	G
821 79/06	249.8	334.2	84.4	G
NZ 5007	256.1	333.9	77.8	B
PN 870 Veronese	232.0	308.0	76.0	G
821 73/01	282.1	357.2	75.1	G
PN 559 Tasman	223.0	298.0	75.0	G
821 56/01	235.1	306.0	70.9	G
821 52/08	188.8	257.0	68.2	M
821 79/10	236.2	304.0	67.8	M
PN 895 Yeogi 1	229.0	296.0	67.0	G
NZ 5006 Kawa	200.5	266.0	65.5	M
821 52/01	238.8	304.0	65.2	M
821 71/07	301.7	354.0	52.3	G
SED DBH (Clone & Year) = 11.3	P<0.001		SED (Clone) = 8.0	P<0.001

B.. 1991 Plantings

Code Assessment	1999	2003	Increment	Vigour/Form
PN 850/2 Eridano	185.8	329.5	143.8	M
830 20/01	222.0	357.5	135.5	G
830 11/15	218.5	342.0	123.5	G
830 43/01	206.3	328.8	122.5	G
830 26/12	169.1	289.8	120.7	G
830 17/01	188.5	308.5	119.9	G
830 17/23	151.8	271.2	119.4	G
830 43/07	189.7	307.7	118.0	G
PN 850 Eridano	179.0	295.0	116.0	M
830 26/14	182.9	296.0	113.1	G
830 13/19	153.0	265.0	112.0	M
830 27/03	148.5	260.0	111.5	G
830 43/05	203.8	314.8	111.0	G
830 30/01	177.0	286.0	109.0	G
830 22/01	133.1	233.0	99.9	G
830 22/21	164.5	262.0	97.5	M
PN 870 Veronese	177.0	274.0	97.0	G
830 11/32	230.5	324.0	93.5	G
NZ 5006 Kawa	156.2	241.8	85.6	M
NZ 5010 Crowsnest	106.8	187.8	81.0	B
SED DBH (Clone & Year) = 19.4	P<0.001		SED (Clone) = 7.4	P<0.001

Spring 2002 Assessment

For the 1990 planting at the October 2002 assessment, 821 71/07 and 821 73/01 were the earliest clones to develop, followed by 821 79/10 and Flevo (PN462), these recording a high ranking for both bud break and leaf density. Conversely, the slowest clones to develop in spring were Kawa (NZ 5006) and Yeogi 1 (PN 895), plus 821 52/08. Most other lines were moderately well developed at the time of assessment.

The earliest clones to develop in the 1991 planting were Eridano, 830 11/32 and 830 26/14. These were followed by 830 11/15, 830 26/12, 830 27/03, 830 30/01 and 830 43/01. The slowest clone to develop was again Kawa (NZ 5006), followed by Crowsnest (NZ 5010), Veronese (PN 870), 830 17/01 and 17/23, and 830 22/21. Other lines were moderately well developed at the time of assessment.

Catkins were most apparent on 821 77/02 (1990 planting) during spring, with 821 56/01 and Veronese (PN 870) also having many. They were least prevalent in Flevo and Tasman, along with Yeogi 1, Kawa, 821 79/06 and 821 79/10. In the 1991 planting, catkins were present with Veronese and Crowsnest, plus 830 20/01. Clones with no catkins included 830 11/15 and 11/32, 830 13/19, 830 22/01 and 22/21, 830 26/14 and 830 27/03.

A distinctive bronze-green leaf colour was noted for Veronese, Tasman, 800 08/09, 821 52/01 and /08, and 821 56/01 (1990 planting). Dark green foliage was noted on 821 71/07, 821 73/01 and 821 79/10, with lighter green on Yeogi 1 and NZ 5007. For the 1991 planting, bronze-green leaves were evident in Veronese, Crowsnest and 830 26/12. Dark green clones included 830 11/32, 830 26/14, 830 43/01 and Eridano, cf light green in 830 22/21, 830 20/01 and 830 13/19.

Autumn 2003 Assessment

Although senescence was well advanced by the April 2003 assessment, several clones still retained green foliage. In the 1990 planting, they included NZ 5007, 821 73/01 and to a lesser extent 821 79/10. Most advanced senescence was noted in 800 08/09 and 821 52/08, and to a lesser extent Flevo and Yeogi 1. In the 1991 planting only 830 26/14, and to a lesser extent Kawa and Veronese, retained green foliage. 830 27/03 had the most advanced senescence, followed by 830 11/15 and 11/32, Crowsnest and 830 43/07.

Degree of bark roughness was as follows: clones with greatest roughness included Kawa, Flevo, 800 08/09, and to a lesser extent Tasman and Veronese (1990 planting); and Kawa and 830 43/01 (1991 planting). Smoother barked clones included 821 52/08 and 821 77/02 (1990); and 830 13/19, 830 22/01, 830 27/03, and 830 30/01 (1991).

E: Henley/Lawrence Poplar Clone Height/DBH comparison

The Henley poplar trees are now 17 years old and are approaching maturity. Comparing their mean tree height, DBH and increments (1999 – 2003) with those of the Lawrence trees (12-13 years old) indicates that growth rates at Henley are considerably slower (Table 4).

Table 4. Comparison of mean tree height (m) and DBH (mm), and increments for Lawrence and Henley, 1999 to 2003.

Site	Henley 1986	Lawrence 1990	Lawrence 1991
Measurement			
Tree Height Increment	4.5	6.6	7.4
1999 Mean Tree Height	14.8	14.0	10.9
2003 Mean Tree Height	19.3	20.6	18.3
Tree DBH Increment	69	75	111
1991 Mean DBH	195	241	177
2003 Mean DBH	264	316	288

The tree height and DBH increments at Henley were about 60% of those for the actively growing 1991 Lawrence trees. Tree heights are now similar to those of the 1990 Lawrence trees but DBH's are about 20% lower. Other than differences in tree age, the reason(s) for this slower growth rate are not immediately apparent. While the Henley site is a sunny aspect, rainfall there is generally a little higher than at Lawrence, thus moisture should not normally be a restricting factor.

As noted, the mean height increment for the measured clones at Henley was about 4.5 m on trees that are now about 19 m in height. The better clones were 800 29/96, 800 15/20, 800 08/02 and 08/09 with increments exceeding 6.5 m. Maximum tree heights ranged from 21 to 23 m, the highest being 800 08/09 at about 26 m.

The mean height increment for the measured clones at Lawrence was about 6.6 m (1990 planting) on trees that are now about 21 m height, and about 7.4 m (1991 planting) on trees that are now about 18 m height. The better clones from the 1990 planting were 821 79/10, 821 77/02, 800 08/09 and 821 77/07 with a height increment of 6 to 7 m. Maximum tree heights ranged from 21 to 22 m, the highest being 821 79/10 at about 23 m. From the 1991 planting the better clones were 830 17/23, 830 11/15, 830 30/01 and 830 20/01 with an increment of 7 to 8 m. Maximum tree heights ranged from 18 to 19 m, the highest being 830 17/23 at just over 19 m.

About 30% of the trees at Henley now have a DBH in excess of 300 mm. Given a log of approximately 5 m clear length, timber volume for those trees is about 0.4 m³. The largest trees (at about 470 mm) have a timber volume of around 0.9 m³. At Lawrence (1990 planting), 77% of the trees had a DBH greater than 300 mm and 20% were over 350 mm. For the 1991 planting, 50% of the trees had a DBH greater than 300 mm.