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**PROVENANCE, FAMILY AND
INDIVIDUAL PLUS TREE SELECTION
IN AN 11-YEAR-OLD *E. FASTIGATA*
PROGENY/PROVENANCE TRIAL**

by

F.C. Burger

Report No. 1

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SUMMARY

In 1979 an *E. fastigata* progeny/provenance trial was established at two central North Island sites in New Zealand. 126 seedlots were involved, 115 of which were open pollinated families and 11 multiple parent composites. Nine native Australian provenances are represented by 69 progenies; 15 New Zealand populations by 51 progenies and one South African population by 6 progenies.

The exotic families were generally from plus trees selected for good growth and form and the native families mostly from random trees.

Eleven years after establishing a single tree plot test at two sites, trees were measured for diameter breast height and were evaluated for form and seed production.

Multi trait index selection across sites was used to rank all the families and to select the best families. Mean diameter and form for these were 11.6% and 9.9% respectively above the test mean.

Provenance/population differences were significant, with the New Zealand populations generally being inferior with the exception of Oakura. The Natal population (R.S.A.) and Oberon provenance (NSW) ranked best overall.

Within provenances/populations significant family differences were found. For example, the New Zealand Oakura population contained two of the very best and one of the worst families.

Note: This material is unpublished and must not be cited as a literature reference

Towards deciding on forward selection, an index combining family and individual information was used to rank individual trees at each site separately. This index selected large numbers of forward selections from only a few outstanding families and a limit was set on the number of trees chosen from any one family. Selection, however, was hampered by a paucity of flowering/seed production and final selections are still to be made.

Some site x family interaction existed for the trait diameter; this effect, although statistically significant, was small and contributed little to overall variance for that trait. Strong favourable genetic correlations existed for the traits investigated.

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INTRODUCTION

A considerable amount of work has been done in the past in New Zealand on the initiation of breeding programmes in various Eucalypt species. These programmes all derive from the work of M.D. Wilcox in the 1970's and early 1980's (Wilcox, 1980). The present stage of development of these programmes has been recently described (Shelbourne, 1989a) and a range of breeding and seed orchard strategies has been investigated (Shelbourne, 1989b). An Eucalypt Breeding Cooperative was formed in 1989 by the Forest Research Institute and Forest Industry Organisations.

This report contains a reassessment of an 11 year old *E. fastigata* progeny/provenance trial; the assessment was undertaken as part of the Cooperative's current improvement programme for *E. fastigata*.

Eucalyptus fastigata, Deane & Maiden occurs naturally in the central and southern part of the main dividing range in New South Wales and also extends into Victoria southeast of Bendoc. The species has good solid wood and pulp properties and was incorporated in the New Zealand Eucalyptus improvement programme in the late nineteen seventies.

This trial contains 126 seedlots, 115 of which were open pollinated families and 11 multiple parent composites. Nine native Australian provenances are represented by 69 progenies; 15 New Zealand populations by 51 progenies and 1 South African population by 6 progenies. Most of the exotic families were from plus trees selected for good growth rate and crown form; most of the native families were from random trees.

Further details of the 126 seedlots involved are given in Table 1, page 17.

The trial was planted out on two sites (Kinleith and Kaingaroa) in 1979.

First assessment of the trial occurred in 1980 (height growth and frost tolerance at one site); further assessments took place in 1981 (incidence of forking) and in 1984 (diameter, height, straightness, branch quality, forking and flowering) and have already been reported upon (Wilcox, M.D. 1982; St Clair, J.B. 1985).

An assessment of this trial was completed in 1990 at age 11 years. Objectives of this assessment were as follows:

1. Updated ranking of families.
2. Ranking of provenances and determining the importance of provenance selection.
3. Selection of best trees in best families for establishment of a production population by means of collecting scions for clonal orchards and OP seed for seedling seed orchards.
4. Selection of about best 80% of families and best trees within these families for collection of OP progenies to establish the next breeding population.

All origins in this trial will be generally referred to as provenances although they represent either native provenances or exotic populations. Distinction between provenance and population is made, however, where appropriate.

MATERIALS AND METHODS

Details of the seedlots used in this trial are given in Table 1. They will be normally referred to as families although a few of them are composites.

Planting and design

A set in rep design was used with 3 sets of 42 seedlots each. One tree of each seedlot was randomised within each set rep. Tests were laid out on two sites, Kinleith and Kaingaroa. The Kinleith site contained 36 replicates and Kaingaroa 42 replicates of each seedlot. For a more detailed description of the test see the 1985 assessment (St Clair, 1985).

Assessment

The trial was assessed for three traits:

1. Diameter: dbh in mm
2. Form: Recorded on a 1-9 scale; the higher the score the straighter the tree:
 - 1 = worst form for the site
 - 9 = excellent straightness for the site

This score combines stem straightness, malformation, frequency and size of branching.

3. Seed production: Rated on a 0-3 scale:
 - 0 = no seed
 - 1 = seed noticeable
 - 2 = frequent seasonal capsules produced
 - 3 = extremely fruitful

In addition heights were measured separately on a sample of 76 trees from the Kaingaroa site to obtain a measure of crop height and standing volume.

Statistical analysis

All statistical analyses were carried out using the SAS Statistical Analysis Programme on a Vax computer.

Family means were calculated as arithmetic means for each site separately and over both sites combined. Arithmetic means were very similar to least-squares means which were used later in the analysis in calculating adjustments for rep effects.

With the trial approaching 11 years of age canopy closure had occurred and several trees were very small and dead or dying as a result of crown suppression. In some instances during the assessment these trees were measured and in other cases they were marked down as "too small" or "dead". In the interest of consistency it was decided to drop all trees with a diameter of less than 100 mm.

Analysis of variance was used to examine the nature and significance of variation existing at the provenance and family level. The GLM procedure (SAS) was used. Sets were ignored in the model after preliminary analyses confirmed that there were no significant effects caused by partitioning of the seedlots into sets.

For individual sites the model analysing families was:

$$Y_{ij} = \mu + f_i + r_j + e_{ij} \quad (1)$$

where Y_{ij} = the observation in the
 j^{th} replicate of the i^{th} family

μ = the overall mean
 f_i = the effect of the i^{th} family
 r_j = the effect of the j^{th} replicate
 e_{ij} = random error associated with the ij^{th} tree in the j^{th} rep in the i^{th} family

For two sites the model was:

$$Y_{ijk} = \mu + f_i + s_k + (fs)_{ik} + r_j: s_k + e_{ijk} \quad (2)$$

where Y_{ijk} = the observation on the k^{th} site in the j^{th} rep of the i^{th} family

μ = the overall mean
 f_i = the effect of the i^{th} family
 s_k = the effect of the k^{th} site
 $(fs)_{ik}$ = the effect of the interaction of the i^{th} family and the k^{th} site
 $r_j: s_k$ = the effect of the j^{th} rep on the k^{th} site (rep effects nested within sites)
 e_{ijk} = random error associated with the k^{th} site on the ijk^{th} tree in the j^{th} rep in the i^{th} family

To test whether or not there was a significant interaction of provenance with families the most variable site (Kinleith) was chosen and the following model applied:

$$Y_{ijk} = \mu + p_i + r_j + (rp)_{ji} + f_{k: p_i} + e_{ijk} \quad (3)$$

where Y_{ijk} = the observation on the i^{th} provenance in the j^{th} rep of the k^{th} family

μ = overall mean

p_i = the effect of the i^{th} provenance

r_j = the effect of the j^{th} rep

$(rp)_{ji}$ = the effect of the interaction of the j^{th} rep with the i^{th} provenance

$f_{k: p_i}$ = the effect of the k^{th} family within the i^{th} provenance (family effects nested within provenance)

e_{ijk} = random error associated with the e_{ijk}^{th} tree in the i^{th} provenance in the j^{th} rep in the k^{th} family

As rep x provenance interaction proved to be non significant this model was simplified to:

$$Y_{ijk} = \mu + p_i + r_j + f_{k: p_i} + e_{ijk} \quad (4)$$

with the rep x provenance interaction incorporated in the error term.

Genetic Analyses

Heritabilities

The variance of family means σ_F^2 was estimated at each site separately as:

$$\hat{\sigma}_F^2 = \hat{\sigma}_f^2 + \frac{\hat{\sigma}_e^2}{t} \quad (5)$$

where σ_f^2 and σ_e^2 are the variance components of family and error respectively as

estimated in the model given by equation (1) and t is the mean number of trees per family at each site.

For both sites combined with sites considered to be a random effect the variance of family means (σ_F^2) was estimated as:

$$\hat{\sigma}_F^2 = \hat{\sigma}_f^2 + \frac{\hat{\sigma}_e^2}{t} + \frac{\hat{\sigma}_s^2}{2} \quad (6)$$

The repeatability of family means (h_F^2) was estimated at each site separately, and for both sites combined, as:

$$\hat{h}_F^2 = \frac{\hat{\sigma}_f^2}{\hat{\sigma}_F^2} \quad (7)$$

in which σ_f^2 is the variance component of families and σ_F^2 the variance component of family means.

Within sites individual heritabilities (h^2) were estimated as:

$$\hat{h}^2 = \frac{4 \hat{\sigma}_f^2}{\hat{\sigma}_f^2 + \hat{\sigma}_e^2} \quad (8)$$

This model assumes a truly half-sib family situation (random mating) where a quarter of the total additive variance occurs between families. However, several sources of non-random mating occur. Apart from neighbourhood inbreeding the effective number of pollinators is probably very limited also. As a result of this the actual amount of additive variance between families is higher, probably closer to a third of the total additive variance (pers. comment, R. Burdon).

It was therefore decided to readjust formula (8) and estimate individual heritabilities as

$$\hat{h}^2 = \frac{3 \hat{\sigma}_f^2}{\hat{\sigma}_f^2 + \hat{\sigma}_e^2} \quad (9)$$

Phenotypic and genetic correlations between traits

The genetic correlation between traits was estimated by firstly executing an analysis of covariance to generate the mean cross products from the family means at each site.

The genetic correlation between traits was estimated for each site separately according to the formula:

$$r_{g\ x,y} = \frac{MCP_{fxy} - MCP_{error\ xy}}{\sqrt{(MS_{fx} - MS_{error\ x})(MS_{fy} - MS_{error\ y})}} \quad (10)$$

in which MCP_{fxy} = mean cross products for families of trait_x and trait_y.
 MS_{fx} = mean squares for families of trait_x

The genetic correlation between traits over sites was calculated as:

$$r_{g\ x,y} = \frac{r_p}{\sqrt{h_x^2 \ h_y^2}} \quad (\text{Burdon, 1977}) \quad (11)$$

in which:

r_p = phenotypic correlation between traits

h_x^2 = individual heritability of trait x at site a

h_y^2 = individual heritability of trait y at site b

x = y if same trait is considered over 2 sites

Phenotypic correlations were calculated for family means using the PROC CORR procedure of SAS.

Index selection

A Smith-Hazel index (Lin's 1978 Terminology), taking into account heritabilities of traits and their genetic and phenotypic correlations, was used.

Firstly, families were ranked over both sites according to the index:

$$I = b_1 \overline{X}_{KINLEITH}^{DIAM} + b_2 \overline{X}_{KINLEITH}^{FORM} + b_3 \overline{X}_{KAINGAROA}^{DIAM} + b_4 \overline{X}_{KAINGAROA}^{FORM} \quad (12)$$

in which:

$$\begin{aligned} I &= \text{index value} \\ b &= \text{index coefficient} \\ \bar{X} &= \text{family mean for trait} \end{aligned}$$

Programme RESI (restricted selection index) written by Jackson, Cotterill and Dean was used to determine the b coefficients of the index by solving the equation:

$$[b] = [P]^{-1} [A] [w] \quad (13)$$

where $[P]$ and $[A]$ are matrices of the phenotypic and additive genetic variances and covariances, respectively, and $[b]$ and $[w]$ are vectors of index coefficients and economic weights.

Secondly, individual trees at each site separately were ranked on an index combining both family and individual information. Genetic correlations as calculated according to (10) were used. Phenotypic correlations were calculated for individual tree values using the PROC CORR procedure in SAS.

This second index was of the type

$$I = b_1 \bar{X}_{\text{DIAM}} + b_2 \hat{X}_{\text{DIAM}} + b_3 \bar{X}_{\text{FORM}} + b_4 \hat{X}_{\text{FORM}} \quad (14)$$

in which:

$$\begin{aligned} I &= \text{index value} \\ b &= \text{index coefficient} \\ \bar{X} &= \text{family-mean value for trait} \\ \hat{X} &= \text{individual value for trait, adjusted for block effects} \end{aligned}$$

$\hat{X}$ was calculated as:

$$\hat{X} = X + (\bar{X} - X_1) \quad (15)$$

in which:

$$\begin{aligned} \hat{X} &= \text{individual-tree value adjusted for replicate effects} \\ X &= \text{individual-tree value} \\ \bar{X} &= \text{overall site mean} \\ X_1 &= \text{least-squares-mean for replicate} \end{aligned}$$

Different economic weightings were applied for both indices:

Ratios of economic weights of 1:1, 2:1, 3:1, 4:1 for diameter: form were applied. The weightings were obtained by dividing each weight by the standard deviation for the trait.

The purpose of ranking individual trees was twofold:

- *To assist in selecting the best trees for a production population*

The family index identified the top 22 families the individual-tree index can be used to select the best trees within these families; seed from these can be used for establishment of seedling seed orchards. Scions can be collected for establishment of a clonal orchard.

- *To assist in selecting the best trees for building up of a breeding population*

This breeding population should have a wide genetic base and still consists of say 100 out of the original 126 families (pers. comment T. Shelbourne).

The family index can be used to identify the worst families. The individual-tree index is then to be used to select the best trees within the remaining say 100 families.

RESULTS AND DISCUSSION

Index

The index used to rank the families appeared to be quite robust: firstly the top 22 families were chosen on an index equally weighting diameter and form. An index with a 4:1 weighting ratio of diameter and form would still select 88% of these 22 families although family rankings would change slightly.

A similar pattern emerged when varying economic weights on the index used to select individual plus trees.

An index applying a 2:1 weighting ratio on diameter and form was used to rank families and individual plus trees.

Provenances

Provenance differences were highly significant as were differences between families within provenance (see Tables 2 and 3)

In ranking of provenances the arbitrary decision was taken that they should be represented by at least 4 families. This meant dropping over half of the New Zealand populations, eight of which consisted of only one seedlot. Provenance rankings were calculated by taking the mean index value of the origins representing the provenance and ranking these.

The Oberon provenance ranked best overall, followed closely by the Natal population. Barrington Tops, Rossi and NZ Oakura also ranked well. The NZ populations were generally poor with exception of Oakura and Cambridge. Kaingaroa ranked lowest for DBH and second lowest for form, making it the lowest ranked provenance overall (see Appendix, Table 14).

The generally low ranking of the NZ populations shows that, although their seed was collected from plus trees, the original seed source must have been inferior and may have suffered from inbreeding depression.

Compared with the 1985 assessment no big changes in ranking occurred with exception of the Barrington Tops provenance which moved up from rank 7 to rank 3.

Families

Significant family differences exist for both diameter and form. The Anova for diameter over both sites shows that there is some site x fam interaction; this effect, although statistically significant, is small and contributes little (1%) to overall variance for that trait; it can be concluded that this interaction is so minor that it may be safely omitted from the model.

Results of the analysis of variance for diameter and form for each site separately (Equation [1]) and for both sites combined (Equation [2]) are presented in Tables 4, 5 and 6.

Families were ranked on index and on family means for diameter, form and flowering. The big differences between families even within provenances are illustrated by the Oakura population: At the Kinleith site its best families ranked No. 1 and No. 2 for diameter while its worst family ranks No. 123 (out of 126) for the same trait.

Exceptional families ranking best for both diameter and form are family 125 from Natal and family 103 from NZ Oakura; these families also ranked best in the 1985 assessment; family 124 (Natal), still ranked in the top 4 in 1985, moved to rank 20.

Considering that most of the native families were not from intensively selected parents the Oberon families 2 and 8 and Barrington Tops family 117 did very well. Family 105 (Oakura) still big but of poor form in 1985 and ranking then second for DBH, now ranked 55 on index and 45 on diameter.

Flowering was sparse overall and totally absent in 10 families. Flowering scores showed strong positive skewness in distributions. No analysis of variance was carried out for this trait nor were heritabilities calculated.

Index rankings, family means and ranks over both sites for diameter, form and flowering are given in Appendix, Table 15. Family means and rankings for diameter, form and flowering for each site separately are given in Appendix, Tables 16 and 17.

The top 22 families (excluding composites) are list in Table 7.

Seed, if present, can be collected from the best trees in these families for establishment of seedling seed orchards. Scions can be collected for establishment of clonal orchards.

Estimates of genetic and phenotypic correlations of family means are given in Table 8. Genetic correlations between Kinleith and Kaingaroa for diameter and form were high being 0.86 and 0.92 respectively.

Family heritabilities are given in Tables 4 and 5. The Kaingaroa site, being more uniform, displayed higher heritabilities. See Table 11 for the standard index output.

Gains from family selection were calculated as:

$$\Delta g = S h_{\bar{F}}^2 \quad (16)$$

where:

Δg = gain

S = selection differential

$h_{\bar{F}}^2$ = repeatability of family means

Gains of family selection are summarised in Appendix, Table 18.

Families and Provenances

The 2 Natal families were best for growth and form. Note the excellent form of the Barrington Tops families. Oberon seemed to be the best provenance overall with 8 out of its 10 families in the top 22 families. The Oberon provenance ranked also best for frost resistance in the 1982 assessment. The top 22 families came from seven provenances (see Table 9).

Plus Tree Selections

With a limited number of traits and favourable genetic correlations a good response from selection can be expected. However, ranking of individual trees according to index showed that a few outstanding families produced many plus trees. At the Kaingaroa site, e.g. the top 100 trees as ranked by index contained 45 trees originating from 3 families: 125 (Natal), 103 and 104 (Oakura).

For the breeding population an arbitrary limit on number of trees per family has to be set. A maximum of 4 trees out of the outstanding families is hereby proposed as the best possible compromise between obtaining short-term gain and maintaining long-term genetic potential (King and All 1990).

Plus tree selections are further hampered by paucity of flowering/seed production. At Kaingaroa 75% of the first 500 trees ranked on index were scored as having no seed. At Kinleith this figure rose to 84%. One might expect that, although seed production is low, due to the height of the trees some trees with a little seed have been assessed as having no seed.

For this reason objectives 3 and 4 of the assessment (see page 2) are only partially fulfilled at this point in time: families and all individual trees have been ranked but paucity of seeding/seed production has lead to postponement of final selections.

For the rankings of individual trees at Kinleith and Kaingaroa see Appendix Table 19 (Kaingaroa) and Table 20 (Kinleith).

The "b" coefficients of the index combining both family and individual information (see equation [14]) were calculated using RESI 3, a CSIRO computer programme. For index output see Table 12 (Kaingaroa) and Table 13 (Kinleith). The phenotypic correlation between diameter and form of individual trees was calculated using the PRO CORR procedure, see Table 10. Individual-tree heritabilities were initially calculated using equation [8], see Tables 5 and 6.

However, open pollinated seed from natural stands of *E. fastigata* most likely consists of a mixture of outcrossed and inbred seed resulting from selfing and from mating of related individuals (see Griffin and Cotterill 1988). As a result of this the actual amount of additive variance between families is higher than a quarter of the total variance. Individual-tree heritabilities as used in the index were therefore adjusted using equation [9].

CONCLUSIONS AND RECOMMENDATIONS

Eucalyptus fastigata displays ample genetic variability which can be harnessed by breeding to improve upon the main selection traits diameter and form. This genetic variation exists at both family and provenance level. The best performing families covered the complete geographical range indicating that provenance selection on its own is not very effective.

Selection of plus trees for both breeding and production population is hampered by poor seeding.

An index was used to rank the families over both sites. For the breeding population the lowest ranking 20% of these families can be dropped. Individual trees have also been ranked and this ranking could be used to draw up a list of the best trees in remaining 80% of the families. Very little seed is needed to reconstruct the breeding population and inspection of candidate trees using binoculars will soon reveal whether or not this seed is available. Additional progenies can be collected from, e.g. the Oberon provenance, improved South African populations and from Kaingaroa Cpt 107 and 1104 (Barrington Tops and Oberon) and Cpt 1208 (NSW and RSA provenances).

The production population will consist of "forward-selected" trees; seed and scions will be collected from best trees in identified best 22 families for establishment of seedling seed orchard and clonal orchard respectively. Seed collected in 1985 from the best families could be included.

The trial can be converted into a seedling seed orchard by thinning and fertilising. A thinning which removes half of the families according to index rank is recommended: plus trees however which were selected for the breeding population but came from the lower ranked families should be left if no seed could be collected from these yet.

Further culling on phenotype in the remaining families should be carried out to achieve an overall final stocking of 100 sph. Family identity of trees remaining after thinning is to be maintained.

Identifying good flowering and seed producing sites is of foremost importance in the establishment of orchards and next round of progeny trials.

Sufficient seed from an average rated family should be collected to be used as control seedlot in future trials.

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TABLES

TABLE 1 - Origins of *E. fastigata* seedlots in New Zealand breeding programme

Origin	Lat. (S)	Long. (E)	Alt. (m)	Number of Seedlots Treated as Families Composites		Total	Composite Seedlot Number(s)	
New South Wales								
Barrington Tops	31° 50'	151° 20'	1370	7	1	8	122	
Yetholme	33° 27'	149° 49'	1210	1		1		
Oberon	33° 54'	149° 48'	1220	10	1	11	58	
Robertson	34° 35'	150° 36'	720	13		13		
Rossi	35° 29'	149° 30'	970-1070	13		13		
Tallaganda	35° 30'	149° 25'	970-1070	3		3		
Badja	36° 13'	149° 29'	1070	1	2	3	80	114
Bombala	37° 08'	149° 12'	910	13	1	14	60	
Victoria								
Bendoc	37° 10'	148 55'	1070	1	2	3	73	111
South Africa								
Draycott, Natal	29° 00'	29° 45'	1500	6		6		
New Zealand								
Tairua	37° 09'	175° 50'	20	1		1		
Cambridge	37° 53'	175° 29'	40	5		5		
Ngahinapouri	37° 53'	175° 15'	40		1	1	123	
Rotoehu	37° 56'	176° 35'	90	1		1		
Tikitere	38° 04'	176° 22'	350	4		4		
Rotorua	38° 09'	176° 15'	305	7		7		
Waimana	38° 08'	177° 05'	30	1		1		
Kaingaroa	38° 31'	176° 35'	460	4	1	5	47	
Lake Mangamahoe	39° 07'	174° 07'	150	1		1		
Oakura	39° 08'	173° 59'	125	11	1	12	110	
Hunterville	39° 55'	175° 33'	300	9		9		
Broughton Bay	41° 13'	173° 56'	20	1		1		
Lake Ahaura	42° 33'	171° 44'	300	1		1		
Heathcote	43° 35'	172° 42'	150		1	1	83	
Charteris Bay	43° 40'	172° 43'	60	1		1		
			Total	115	11	126		

**TABLE 2 - ANALYSIS OF VARIANCE, KINLEITH, INCORPORATING
PROVENANCE (i.e. ORIGIN) CLASSIFICATION**

Trait	Source	DF	Mean Square	F Ratio	Variance Component Estimate	
DBH	REP	35	46935.73	16.43*	σ_r^2	503.26
	ORIGIN	24	18790.26	3.64*	σ_p^2	115.00
	FAM (ORIGIN)	101	5165.96	1.81*	$\sigma_{f:p}^2$	90.72
	ERROR	2989	2856.86		σ_e^2	2856.86
FORM	REP	35	19.73	5.75*	σ_r^2	0.1861
	ORIGIN	24	20.42	2.44*	σ_p^2	0.1046
	FAM (ORIGIN)	101	8.38	2.45*	$\sigma_{f:p}^2$	0.1953
	ERROR	2979	3.43		σ_e^2	3.43

**TABLE 3 - ANALYSIS OF VARIANCE, KAINGAROA, INCORPORATING
PROVENANCE CLASSIFICATION**

Trait	Source	DF	Mean Square	F Ratio	Variance Component Estimate	
DBH	REP	41	9520.56	4.46*	σ_r^2	89.09
	ORIGIN	24	26481.84	5.04*	σ_p^2	162.58
	FAM (ORIGIN)	101	5257.87	2.46*	$\sigma_{f:p}^2$	113.31
	ERROR	3277	2134.09		σ_e^2	2134.09
FORM	REP	41	12.77	4.08*	σ_r^2	0.1166
	ORIGIN	24	21.54	2.30*	σ_p^2	0.0957
	FAM (ORIGIN)	101	9.36	2.99*	$\sigma_{f:p}^2$	0.2263
	ERROR	3270	3.13		σ_e^2	3.13

* Significant at the $P < 0.01$ level.

TABLE 4 - ANALYSIS OF VARIANCE, KINLEITH, FAMILIES OVERALL

Trait	Source	DF	Mean Square	F. Ratio	Variance Components		Heritability Estimate
DBH	REP	35	46935.73	16.43*	σ_r^2	503.27	$\hat{h}^2 = 0.26$
	FAM	125	7781.82	2.72*	σ_f^2	197.69	$\hat{h}_{\frac{2}{F}}^2 = 0.63$
	ERROR	2989	2856.86		σ_e^2	2854.86	
					σ_F^2	311.97	
FORM	REP	35	19.73	5.76*	σ_r^2	0.1861	$\hat{h}^2 = 0.31$
	FAM	125	10.69	3.12*	σ_f^2	0.2926	$\hat{h}_{\frac{2}{F}}^2 = 0.68$
	ERROR	2979			σ_e^2	3.4285	
					σ_F^2	0.4307	

Table 5 - ANALYSIS OF VARIANCE, KAINGAROA, FAMILIES OVERALL

Trait	Source	DF	Mean Square	F. Ratio	Variance Components		Heritability Estimate
DBH	REP	41	9520.56	4.46*	σ_r^2	89.17	$\hat{h}^2 = 0.44$
	FAM	125	9332.87	4.37*	σ_f^2	264.51	$\hat{h}_{\frac{2}{F}}^2 = 0.77$
	ERROR	3277	2134.09		σ_e^2	2134.09	
					σ_F^2	342.68	
FORM	REP	41	12.77	4.08*	σ_r^2	0.1167	$\hat{h}^2 = 0.37$
	FAM	125	11.70	3.73*	σ_f^2	0.3154	$\hat{h}_{\frac{2}{F}}^2 = 0.73$
	ERROR	3270	3.13		σ_e^2	3.1327	
					σ_F^2	0.43	

* Significant at the P < 0.01 level.

**TABLE 6 - ANALYSIS OF VARIANCE: BOTH SITES COMBINED,
IGNORING PROVENANCE CLASSIFICATION**

Trait	Source	DF	Mean Square	F Ratio	Variance Component Estimate % of total		
DBH	SITE	1	1279133.35	516.02*	σ_s^2	380.06	(11%)
	FAM	125	13721.73	5.54*	σ_f^2	196.80	(6%)
	SITE * FAM	125	3413.03	1.38*	$\sigma_{(fs)}^2$	32.49	(1%)
	REP (SITE)	76	26718.24	10.78*	$\sigma_{r.s}^2$	290.47	(9%)
	ERROR	6266	2478.87		σ_e^2	2478.87	(73%)
FORM	SITE	1	624.95	190.90*	σ_s^2	0.1852	(5%)
	FAM	125	18.53	5.66*	σ_f^2	0.2833	(7%)
	SITE * FAM	125	3.74	1.14	$\sigma_{(fs)}^2$	0.0159	(0.4%)
	REP (SITE)	76	16.19	4.94*	$\sigma_{r.s}^2$	0.1551	(4%)
	ERROR	6249	3.27		σ_e^2	3.27	(83.6%)

* Significant at the $P < 0.01$ level.

Although there is some site x fam interaction for the trait DBH, its effect is small and contributes little (1%) to overall variance for that trait. It was concluded that this interaction could be omitted from the model.

TABLE 7 - TOP 22 FAMILIES AS RANKED BY INDEX

FAM	ORIGIN	INDEX	DBH	DBH RANK	FORM	FORM RANK	FLWR	FLWR RANK
125	NATAL	60.98	233	3	7.15	1	0.14	47
103	NZ OAKURA	60.45	237	1	6.73	3	0.21	28
104	NZ OAKURA	57.50	235	2	5.76	61	0.30	15
117	BARRINGTON TOPS	57.00	214	15	7.00	2	0.05	103
8	OBERON	56.46	223	5	6.35	15	0.06	97
2	OBERON	56.30	222	6	5.92	46	0.11	61
68	TALLAGANDA	56.04	219	9	6.28	22	0.13	51
36	BOMBALA	55.88	211	19	6.72	4	0.02	115
116	BARRINGTON TOPS	55.85	211	21	6.63	7	0.03	112
5	OBERON	55.28	216	13	6.22	23	0.17	37
6	OBERON	55.24	220	8	6.15	30	0.11	62
99	NZ OAKURA	55.13	220	7	6.02	39	0.69	2
9	OBERON	55.10	218	10	5.91	47	0.10	69
13	ROSSI	54.71	209	25	6.56	8	0.15	45
4	OBERON	54.68	224	4	5.49	84	0.09	75
10	OBERON	54.22	205	31	6.44	9	0.07	89
115	BARRINGTON TOPS	53.93	202	37	6.68	5	0.13	57
124	NATAL	53.79	213	17	6.01	40	0.07	84
58	OBERON	53.77	213	16	5.83	56	0.06	96
98	NZ OAKURA	53.70	207	27	6.34	16	0.33	13
34	BOMBALA	53.51	209	24	6.06	37	0.17	39
110	NZ OAKURA	53.44	218	11	5.58	79	0.39	8

TABLE 8 - ESTIMATES OF GENETIC CORRELATIONS (ABOVE DIAGONAL)
AND PHENOTYPIC CORRELATIONS (BELOW DIAGONAL) OF FAMILY
MEANS FOR DIAMETER AND FORM AT BOTH SITES

	DBH KIN	FORM KIN	DBH KAIN	FORM KAIN
DBH Kinleith		0.47	0.86	0.36
Form Kinleith	0.39		0.47	0.92
DBH Kaingaroa	0.61	0.34		0.50
Form Kaingaroa	0.25	0.65	0.41	

TABLE 9 - TOP 22 FAMILIES BY PROVENANCE

Provenance	No. families in top 22 (out of total families)		Mean DBH	Mean form	% Above plantation mean	
					DBH	FORM
Natal	2	(6)	223	6.58	14.5	15.5
Oakura	5	(11)	223	6.09	14.5	6.9
Oberon	8	(10)	218	6.04	12.0	6.0
Barrington	3	(7)	209	6.77	7.4	18.8
Tallaganda	1	(3)	219	6.28	12.5	10.2
Rossi	1	(13)	209	6.56	7.4	15.1
Bombala	2	(13)	210	6.39	7.9	12.1

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VARIABLE	N	MEAN	STD DEV	SUM	MINIMUM	MAXIMUM
DBHKIN	3150	211.75301587	59.51707272	667022.00000000	100.00000000	467.00000000
FORMKIN	3140	6.06433121	1.97475345	19042.00000000	1.00000000	9.00000000
DBHKN	3444	183.86962834	49.83377674	633247.00000000	100.00000000	397.00000000
FORMKAN	3437	5.44719232	1.88660362	18722.00000000	0.00000000	9.00000000

PEARSON CORRELATION COEFFICIENTS / PROB > |R| UNDER H0:RHO=0 / NUMBER OF OBSERVATIONS

	DBHKIN	FORMKIN	DBHKN	FORMKAN
DBHKIN	1.00000	-0.00882	0.01629	0.01369
	0.0000	0.6213	0.3609	0.4428
	3150	3140	3150	3144
FORMKIN	-0.00882	1.00000	-0.00487	0.01043
	0.6213	0.0000	0.7848	0.5593
	3140	3140	3140	3134
DBHKN	0.01629	-0.00487	1.00000	0.16440
	0.3609	0.7848	0.0000	0.0001
	3150	3140	3444	3437
FORMKAN	0.01369	0.01043	0.16440	1.00000
	0.4428	0.5593	0.0001	0.0000
	3144	3134	3437	3437

Table 10 - Phenotypic correlation between diameter and form of individual trees

Table 11 - Family selections: standard index output

JOB 1

HERITABILITIES
0.6300 0.6600 0.7700 0.7300

PH VARIANCES
17.6600 0.6562 18.5100 0.6557

PH CORRELATIONS
1.0000
0.3854 1.0000
0.6051 0.3378 1.0000
0.2459 0.6464 0.4146 1.0000

GEN CORRELATIONS
1.0000
0.4700 1.0000
0.8600 0.4700 1.0000
0.3600 0.9200 0.5000 1.0000

PH STAND DEVS
4.2024 0.8101 4.3023 0.8098

GEN STAND DEVS
3.3355 0.6680 3.7753 0.6919

PH (CO)VARIANCES
17.6600
1.3121 0.6562
10.9400 1.1841 18.5100
0.8367 0.4240 1.4444 0.6557

GEN (CO)VARIANCES
11.1258
1.0472 0.4462
10.8296 1.1853 14.2527
0.8208 0.4252 1.3060 0.8787

NO OF SETS OF ECONOMIC WEIGHTS = 4

VARIABLE INPUT FORMAT
(4f8.5)

ECONOMIC WTS SET 1
0.0566 1.5234 0.0540 1.5251

COEFFICIENTS FOR UNRESTRICTED INDEX

0.0297 1.1518 0.0867 1.3068

GENETIC GAIN FOR UNRESTRICTED INDEX IN ECONOMIC WEIGHT UNITS PER UNIT SELECTION DIFFERENTIAL PER GENERATION =

COV(HI) = 4.1957

V(I) = 4.1957 V(H) = 5.0021 R(HI) = 0.9159

GENETIC COVARIANCE BETWEEN Y(J) AND I

3.5605 1.2934 4.6083 1.2531

2.0443

CORRELATED CHANGE IN Y(J) IN ACTUAL UNITS PER UNIT SELECTION DIFFERENTIAL PER GENERATION

1.7382 0.5875 2.2595 0.6117

GENETIC CORRELATION BETWEEN Y(J) AND I

0.4773 0.8055 0.5482 0.8098

ECONOMIC WTS SET 2

0.1132 1.5234 0.1930 1.5251

COEFFICIENTS FOR UNRESTRICTED INDEX

0.0641 1.1716 0.1392 1.3136

GENETIC GAIN FOR UNRESTRICTED INDEX IN ECONOMIC WEIGHT UNITS PER UNIT SELECTION DIFFERENTIAL PER GENERATION :

2.2039

COV(HI) = 5.2163

V(I) = 5.2163 V(H) = 6.1664 R(HI) = 0.9197

GENETIC COVARIANCE BETWEEN Y(J) AND I

4.5390 1.3134 5.7825 1.3620

CORRELATED CHANGE IN Y(J) IN ACTUAL UNITS PER UNIT SELECTION DIFFERENTIAL PER GENERATION

1.9874 0.5751 2.5318 0.5963

GENETIC CORRELATION BETWEEN Y(J) AND I

0.5480 0.7918 0.6168 0.7927

ECONOMIC WTS SET 3

0.1698 1.5234 0.1620 1.5251

COEFFICIENTS FOR UNRESTRICTED INDEX

0.0985 1.1915 0.1918 1.3203

GENETIC GAIN FOR UNRESTRICTED INDEX IN ECONOMIC WEIGHT UNITS PER UNIT SELECTION DIFFERENTIAL PER GENERATION :

2.5441

COV(HI) = 6.4724

V(I) = 6.4724 V(H) = 7.6176 R(HI) = 0.9218

GENETIC COVARIANCE BETWEEN Y(J) AND I

5.5175 1.4235 6.9366 1.4709

CORRELATED CHANGE IN Y(J) IN ACTUAL UNITS PER UNIT SELECTION DIFFERENTIAL PER GENERATION

2.1688 0.5595 2.7266 0.5781

GENETIC CORRELATION BETWEEN Y(J) AND I

0.5993 0.7721 0.6657 0.7703

ECONOMIC WTS SET 4

0.2264 1.5234 0.2160 1.5251

COEFFICIENTS FOR UNRESTRICTED INDEX

Table 12

POPULATION PARAMETERS AS READ FROM LIBRARY FILE
as.lib

Output RESI Kaingaroa

TRAIT-A	TRAIT-B	R(P) OR SD(F)	R(G) OR HSQ	R(CH) OR CHSQ	R(CF) OR CFSQ
1	1	59.5170	0.2000	0.0000	0.0000
1	2	-0.0080	0.4700	0.0000	0.0000
1	3	0.0163	0.8600	0.0000	0.0000
1	4	0.0137	0.3600	0.0000	0.0000
2	2	1.9750	0.2300	0.0000	0.0000
2	3	-0.0049	0.4700	0.0000	0.0000
2	4	0.0104	0.9200	0.0000	0.0000
3	3	49.8330	0.3300	0.0000	0.0000
3	4	0.1644	0.5000	0.0000	0.0000
4	4	1.8870	0.2700	0.0000	0.0000

INDEX PARAMETERS AS READ FROM STANDARD INPUT FILE

job no = 1

E.Fastigata combined index Kaingaroa

no. traits = 2
 no. econ wt. indices = 4
 no. desired gain indices = 0
 no. restricted indices = 0
 no. per half sib family = 27
 no. per full sib family = 0
 no. per progeny group = 0
 trait in index as - I - individual value
 - H - half sib family mean
 - F - full sib family mean
 - O - progeny test mean

		I	H	F	O
1	3 dbhkan	1	1	0	0
2	4 formkan	1	1	0	0

economic weights for indices 1 to 4

trait	index 1	index 2	index 3	index 4	index
1 dbhkan	0.0200	0.0400	0.0600	0.0800	
2 formkan	0.5300	0.5300	0.5300	0.5300	

phenotypic (co)variances - I,H,F,O partitions

	2483.3279				
	15.4593	3.5608			
	289.2617	3.9513		289.2617	
	3.9513	0.3633		3.9513	0.363
3	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000

genetic (co)variances - I,H,F,O partitions

	819.4982				
	14.0345	0.9614			
	227.6384	3.8985		227.6384	
	3.8985	0.2671		3.8985	0.267
1	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000

phenotypic standard deviations - I,H,F,O partitions

	49.8330	1.8870		17.0077	0.602
8	0.0000	0.0000		0.0000	
	0.0000	0.0000		0.0000	

genetic standard deviations - I,H,F,O partitions

	28.6269	0.9805		15.0877	0.516
8	0.0000	0.0000		0.0000	
	0.0000	0.0000		0.0000	

LL TRAITS UNRESTRICTED COMBINED INDEX

T. Fastigata combined index Kaingaroa

ECONOMIC_WT_SET 2

RESTRICTION SET 0

LIB NO	IND NO	TRAIT NAME	*	ECON WT	INDEX_B COEFFICIENT	COV(TRAIT , INDEX)	DELTA_G (TRAIT)	RG(TRAIT , INDEX)
3	1	dbhkan	I	0.04	0.0122	18.3888	18.3264	0.4354
4	2	formkan	I	0.53	0.1980	0.5118	0.5101	0.3538
3	3	dbhkan	H	0.00	0.0200	9.1612	9.1301	0.4116
4	4	formkan	H	0.00	0.2703	0.2507	0.2498	0.3288
3	5	dbhkan	F	0.00	0.0000	0.0000	0.0000	0.0000
4	6	formkan	F	0.00	0.0000	0.0000	0.0000	0.0000
3	7	dbhkan	O	0.00	0.0000	0.0000	0.0000	0.0000
4	8	formkan	O	0.00	0.0000	0.0000	0.0000	0.0000

** - I = individual value

- H = half sib family mean (individual included)

- F = full sib family mean (individual included)

- O = progeny test mean (individual not included, parents unselected)

genetic gains for each trait on selection for index (delta_G)
are in trait_units per unit selection differential per generation

genetic gain in aggregate genotype on selection for index
- in economic weight units

- per unit selection differential per generation = 1.0034

covariance of aggregate genotype & index = 1.0068

variance of index = 1.0068

variance of aggregate genotype = 2.1763

correlation of aggregate genotype & index = 0.6802

heritability of index = 0.4626

POPULATION PARAMETERS AS READ FROM LIBRARY FILE
as.lib

Table 13

Output RESI Kinleith

TRAIT-A	TRAIT-B	R(P) OR SD(P)	R(G) OR HSD	R(CH) OR CHSD	R(CF) OR CFSD
1	1	59.5170	0.2000	0.0000	0.0000
1	2	-0.0080	0.4700	0.0000	0.0000
1	3	0.0163	0.8800	0.0000	0.0000
1	4	0.0137	0.3600	0.0000	0.0000
2	2	1.9750	0.2300	0.0000	0.0000
2	3	-0.0049	0.4700	0.0000	0.0000
2	4	0.0104	0.9200	0.0000	0.0000
3	3	49.8330	0.3300	0.0000	0.0000
3	4	0.1644	0.5000	0.0000	0.0000
4	4	1.8870	0.2700	0.0000	0.0000

INDEX PARAMETERS AS READ FROM STANDARD INPUT FILE

job no = 1

E.Fastigata combined index Kinleith

no. traits = 2
 no. econ wt. indices = 4
 no. desired gain indices = 0
 no. restricted indices = 0
 no. per half sib family = 25
 no. per full sib family = 0
 no. per progeny group = 0
 trait in index as - I - individual value
 - H - half sib family mean
 - F - full sib family mean
 - O - progeny test mean

		I	H	F	O
1	1 dbhkin	1	1	0	0
2	2 formkin	1	1	0	0

economic weights for indices 1 to 4

trait	index 1	index 2	index 3	index 4	index
1 dbhkin	0.0170	0.0330	0.0500	0.0570	
2 formkin	0.5070	0.5070	0.5070	0.5070	

phenotypic (co)variances - I,H,F,O partitions

	3542.2733				
	-0.9404	3.9006			
	311.7200	2.8062		311.7200	
	2.8062	0.3713		2.8062	0.371
3	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000

genetic (co)variances - I,H,F,O partitions

	708.4547				
	11.8491	0.8971			
	198.3673	3.3177		198.3673	
	3.3177	0.2512		3.3177	0.251
2	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000
0	0.0000	0.0000		0.0000	0.000

phenotypic standard deviations - I,H,F,O partitions

	59.5170	1.9750		17.6556	0.609
4	0.0000			0.0000	
	0.0000	0.0000		0.0000	

genetic standard deviations - I,H,F,O partitions

	26.6168	0.9472		14.0843	0.501
2	0.0000				
	0.0000	0.0000		0.0000	

ALL TRAITS UNRESTRICTED COMBINED INDEX

1. Fastigata combined index Kinleith

ECONOMIC WT SET 2

RESTRICTION SET 0

LIB	IND	TRAIT	NAME	*	ECON	INDEX_B	COV(TRAIT	DELTA_G	RG(TRAIT
NO	NO			*	WT	COEFFICIENT	, INDEX)	(TRAIT)	, INDEX)
1	1	dbhkin		I	0.03	0.0068	10.9372	14.7989	0.3475
2	2	formkin		I	0.51	0.1797	0.3654	0.4945	0.3262
1	3	dbhkin		H	0.00	0.0154	5.9567	8.0599	0.3576
2	4	formkin		H	0.00	0.2906	0.1917	0.2594	0.3234
1	5	dbhkin		F	0.00	0.0000	0.0000	0.0000	0.0000
2	6	formkin		F	0.00	0.0000	0.0000	0.0000	0.0000
1	7	dbhkin		O	0.00	0.0000	0.0000	0.0000	0.0000
2	8	formkin		O	0.00	0.0000	0.0000	0.0000	0.0000

** - I = individual value
 - H = half sib family mean (individual included)
 - F = full sib family mean (individual included)
 - O = progeny test mean (individual not included, parents unselected)

genetic gains for each trait on selection for index (delta_G)
 are in trait_units per unit selection differential per generation

genetic gain in aggregate genotype on selection for index

APPENDIX TABLES

TABLE 14 - PROVENANCE/POPULATION MEANS RANKED BY INDEX

Index rank	Origin	Number of families	Index	DBH	DBH rank	Form	Form rank	Flowering	Flower rank
1	Oberon	11	54.0	213	1	5.94	4	0.09	8
2	Natal	6	53.4	202	4	6.37	1	0.26	3
3	Barrington Tops	8	51.8	199	5	6.08	2	0.06	9
4	Rossi	13	51.6	204	2	5.81	6	0.15	5
5	NZ Oakura	12	51.1	203	3	5.56	8	0.32	1
6	Bombala	14	49.5	190	8	6.00	3	0.06	10
7	NZ Cambridge	5	49.4	191	6	5.80	7	0.29	2
8	Robertson	13	47.9	190	7	5.35	9	0.12	6
9	NZ Rotorua	7	47.3	187	10	5.34	10	0.20	4
10	NZ Hunter	9	46.8	186	11	5.12	12	0.05	11
11	NZ Tikitiri	4	46.7	172	9	5.89	5	0.05	12
12	NZ Kaingaroa	5	41.8	162	12	5.13	11	0.09	7

Table 15 - Family rankings Kinleith and Kaingaroa sorted by index

ORS	FAM	ORIGIN	INDEX	DRH11	DRHRANK	FORM11	FORMRANK	FLWR11	FLWRRANK	ELWR11	ELWRRANK
1	125	NATAL	60.9847	233.273	3	7.15132	1	0.142857	47	0.212121	28
2	103	NZOKAKURA	60.4548	237.318	1	6.72727	3	0.212121	15	0.303030	15
3	104	NZOKAKURA	57.4959	234.791	2	5.76119	61	0.303030	15	0.046154	103
4	117	BAKKINGT	56.9953	213.913	15	7.00000	2	0.046154	97	0.097692	97
5	8	OREKON	56.4632	222.636	5	6.34545	15	0.097692	61	0.112903	61
6	2	OREKON	56.3033	232.493	6	5.92424	46	0.112903	61	0.112903	61
7	68	TALLAGN	56.0855	219.188	9	6.27536	22	0.130435	51	0.130435	51
8	36	ROMBALA	55.8826	211.167	19	6.21667	4	0.017544	115	0.017544	115
9	116	BAKKINGT	55.8491	211.029	21	6.62857	7	0.038986	37	0.038986	37
10	5	OREKON	55.2819	215.548	13	6.21918	23	0.169014	37	0.169014	37
11	6	OREKON	55.2363	219.569	8	6.15385	30	0.112903	62	0.112903	62
12	99	NZOKAKURA	55.1342	220.446	7	6.01786	39	0.099099	2	0.099099	2
13	9	OREKON	55.1042	218.225	10	5.91429	47	0.102941	69	0.145455	45
14	13	ROSSI	54.7109	208.527	25	6.55556	8	0.145455	45	0.145455	45
15	4	OREKON	54.6757	223.721	4	5.48529	84	0.099099	75	0.099099	75
16	57	NZCHAKTR	54.5015	211.516	18	6.16129	29	0.724138	1	0.724138	1
17	10	OREKON	54.2219	204.734	31	6.43548	9	0.066667	89	0.066667	89
18	115	BAKKINGT	53.9282	202.103	37	6.67647	5	0.125000	57	0.125000	57
19	94	NZMAIMAN	53.8376	216.830	12	5.43478	86	0.234043	24	0.234043	24
20	124	NATAL	53.7858	212.571	17	6.01429	40	0.074627	84	0.074627	84
21	58	OREKON	53.7661	212.729	16	5.82857	56	0.058824	96	0.058824	96
22	98	NZOKAKURA	53.6982	207.351	27	6.39229	16	0.327273	13	0.327273	13
23	34	ROMBALA	53.5050	209.000	24	6.06000	37	0.166667	39	0.166667	39
24	110	NZOKAKURA	53.4431	217.929	11	5.56182	79	0.388889	3	0.388889	3
25	20	ROSSI	53.3634	207.397	26	6.20588	26	0.169231	36	0.169231	36
26	45	ROBERTSN	53.2669	200.154	42	6.11588	33	0.115385	60	0.115385	60
27	129	NATAL	52.8924	197.795	52	6.38462	14	0.230769	25	0.230769	25
28	15	ROSSI	52.8704	199.045	46	6.42424	10	0.230769	25	0.230769	25
29	126	NATAL	52.8292	200.803	41	6.30986	18	0.357143	10	0.357143	10
30	19	ROSSI	52.7325	206.910	29	6.14925	31	0.106061	66	0.106061	66
31	21	ROSSI	52.6832	209.485	22	5.84615	53	0.129032	52	0.129032	52
32	97	NZKOTOKU	52.6616	209.156	23	5.90625	49	0.328125	7	0.328125	7
33	146	NZCAMBERG	52.3703	197.907	51	6.40741	13	0.392157	2	0.392157	2
34	18	ROSSI	52.3243	204.446	32	6.20000	27	0.031250	110	0.031250	110
35	3	OREKON	52.1616	194.070	64	6.41429	12	0.101449	70	0.101449	70
36	37	ROMBALA	52.1118	193.172	67	6.67241	6	0.068966	88	0.068966	88
37	64	YELTHOLM	52.0507	207.092	28	5.60000	74	0.016393	116	0.016393	116
38	122	BAKKINGT	51.9085	202.369	36	5.84615	54	0.061538	93	0.061538	93
39	7	OREKON	51.7851	211.129	20	5.37097	90	0.033333	108	0.033333	108
40	84	NZKOTOKU	51.7402	196.528	55	6.26302	21	0.269231	20	0.269231	20
41	109	NZMANGAM	51.5918	204.976	30	5.48780	83	0.170732	35	0.170732	35
42	128	NATAL	51.4877	191.962	71	6.42306	11	0.366000	9	0.366000	9
43	55	NZBRUGH	51.4758	201.644	38	5.60000	72	0.204545	29	0.204545	29
44	74	RENDOC	51.3919	193.708	65	6.32306	17	0.171875	33	0.171875	33
45	148	NZCAMBERG	50.9744	194.508	61	6.13846	32	0.269841	17	0.269841	17
46	119	BAKKINGT	50.9456	194.091	63	6.21212	25	0.030769	111	0.030769	111
47	72	TALLAGN	50.9104	199.453	82	6.28816	20	0.122449	58	0.122449	58
48	152	BAJJA	50.8384	202.388	35	5.61194	71	0.062500	92	0.062500	92
49	12	ROSSI	50.8368	203.143	33	5.63265	68	0.166667	38	0.166667	38
50	16	ROSSI	50.7993	202.860	34	5.35088	91	0.000000	117	0.000000	117
51	114	BAJJA	50.7665	201.219	40	5.51563	81	0.332381	14	0.332381	14
52	17	ROSSI	50.7157	197.728	53	5.77778	59	0.213115	27	0.213115	27
53	23	ROSSI	50.5413	201.576	39	5.67727	66	0.234343	22	0.234343	22
54	39	ROBERTSN	50.4534	199.600	59	5.87725	50	0.125000	56	0.125000	56
55	105	NZOKAKURA	50.4232	199.442	45	5.59615	76	0.411785	5	0.411785	5

Family rankings Kinleith and Kaingaroa combined sorted by index 10:43 THURSDAY, JULY 12, 1990 1

OBS	FAM	ORIGIN	INDEX	DEH11	DEHRANK	FORM11	FORMRANK	FLWR11	FLWRRANK
56	80	BANJA	50.4037	198.877	48	5.70769	65	0.109375	63
57	69	TALLAGN	49.9354	192.547	69	5.71875	64	0.126984	55
58	73	BENDOC	49.9192	190.075	83	5.96226	43	0.075472	82
59	22	ROSSI	49.9048	214.839	14	4.24194	124	0.147541	43
60	24	ROSSI	49.6942	190.660	80	5.92453	45	0.040816	105
61	14	ROSSI	49.6803	199.015	47	5.60606	72	0.281250	17
62	121	BARRINGT	49.6723	190.469	81	5.73469	63	0.104167	68
63	60	BOMBALA	49.5549	190.800	78	5.85000	52	0.052632	101
64	41	ROBERTSN	49.5389	191.235	76	6.02941	38	0.176471	32
65	106	NZOAKURA	49.5097	199.930	43	5.21053	97	0.410714	6
66	31	BOMBALA	49.4075	194.529	60	6.29412	19	0.062500	91
67	43	ROBERTSN	49.3530	196.688	34	5.33333	93	0.130435	50
68	54	ROBERTSN	49.2962	185.342	94	6.10526	34	0.081081	79
69	138	NZHUNTER	49.2289	194.161	62	5.58929	77	0.132075	49
70	11	DEERON	49.2087	196.485	56	5.20588	98	0.059701	94
71	81	ROBERTSN	49.1531	198.314	49	5.42857	87	0.237143	21
72	139	NZHUNTER	49.0979	193.267	66	5.37778	89	0.000000	125
73	118	BARRINGT	49.0326	195.651	58	5.19048	100	0.066667	90
74	25	BOMBALA	49.0239	188.857	86	5.96025	41	0.000000	118
75	111	BENDOC	48.8787	192.589	68	5.78571	38	0.075472	83
76	26	BOMBALA	48.8637	191.578	74	5.51563	80	0.000000	119
77	91	NZTIKIR	48.8201	179.321	106	5.96429	42	0.000000	122
78	53	NZROTORU	48.6832	198.220	50	4.94000	111	0.632653	3
79	33	BOMBALA	48.5050	186.804	93	5.74510	62	0.040000	107
80	149	NZCAMBRG	48.4544	189.758	84	5.45161	85	0.278689	18
81	101	NZOAKURA	48.3413	188.814	87	5.41379	88	0.344828	11
82	32	BOMBALA	48.2330	182.533	99	6.08333	36	0.155172	41
83	27	BOMBALA	48.2160	186.842	92	5.59649	75	0.018182	114
84	127	NATAL	48.1508	178.244	109	5.91111	48	0.418605	4
85	100	NZOAKURA	48.0906	185.109	95	5.58182	78	0.200000	30
86	28	BOMBALA	48.0621	180.667	103	6.21429	24	0.100000	71
87	44	ROBERTSN	47.8976	196.077	57	5.02564	109	0.128203	53
88	123	NZNGAHIN	47.8128	191.947	72	5.15789	102	0.127273	54
89	150	NZCAMBRG	47.7434	192.182	70	5.07273	105	0.290909	16
90	30	BOMBALA	47.6793	180.944	101	5.62264	70	0.040000	106
91	107	NZOAKURA	47.6676	199.831	44	4.64063	121	0.145161	46
92	147	NZCAMBRG	47.5750	178.500	107	5.92857	44	0.236364	23
93	141	NZHUNTER	47.2971	191.111	77	4.94444	110	0.079431	80
94	108	NZOAKURA	47.2831	188.811	88	5.10811	104	0.171429	34
95	29	BOMBALA	47.2437	179.466	105	5.82759	57	0.052632	100
96	42	ROBERTSN	47.2407	191.462	75	4.76923	116	0.120000	59
97	92	NZTIKIR	47.1328	177.474	111	5.63138	69	0.026316	113
98	90	NZTIKIR	47.0925	178.455	108	5.85714	51	0.095238	74
99	144	NZHUNTER	46.9670	188.521	89	5.23404	96	0.043478	104
100	137	NZHUNTER	46.9591	189.404	85	4.90385	112	0.076923	81
101	52	NZROTORU	46.8543	183.175	97	5.67500	67	0.000000	121
102	35	BOMBALA	46.6083	178.094	110	5.83019	55	0.058824	95
103	142	NZHUNTER	46.4515	171.846	115	5.76923	60	0.000000	126
104	88	NZROTORU	46.3953	191.800	73	4.88000	114	0.083333	78
105	46	ROBERTSN	46.3296	190.783	79	5.06522	106	0.133333	48
106	120	BARRINGT	46.0750	180.868	102	5.32075	95	0.000000	123
107	136	NZHUNTER	45.9379	187.654	90	4.65385	120	0.000000	124
108	38	ROBERTSN	45.7871	187.388	91	4.57143	122	0.145833	44
109	113	ROBERTSN	45.6449	182.579	98	5.02632	108	0.108108	64
110	96	NZROTORU	45.2940	182.510	100	4.89235	113	0.160000	40

OBS	FAM	ORIGIN	INDEX	DBH11	DBHFRANK	FORM11	FORMRANK	FLWR11	FLWRRANK
111	140	NZHUNTER	45.2800	185.036	96	4.50909	123	0.054545	99
112	63	ROBERTSN	44.7736	180.056	104	5.02778	107	0.057143	98
113	40	ROBERTSN	44.4110	172.240	114	5.20000	99	0.000000	120
114	85	NZROTUFU	44.1018	165.167	119	5.50000	82	0.033333	109
115	49	NZKAINGR	44.0444	162.244	120	6.19512	28	0.097361	73
116	143	NZHUNTER	43.7164	172.816	113	5.13158	103	0.105263	67
117	89	NZTIKITE	43.6329	151.116	126	6.09302	35	0.071429	86
118	135	NZAHARA	43.2812	158.400	122	5.33333	94	0.071429	87
119	48	NZKAINGR	42.8012	169.633	117	4.76667	117	0.107143	65
120	112	NZTAIRUA	42.4132	175.095	112	4.04762	126	0.150000	42
121	102	NZDAKURA	41.7956	160.143	121	4.74286	118	0.181818	31
122	50	NZKAINGR	41.6054	171.553	116	4.65957	119	0.086957	77
123	83	NZHEATHC	41.1889	152.043	125	5.34783	92	0.090909	76
124	51	NZKAINGR	40.7820	152.045	124	5.18182	101	0.100000	72
125	87	NZROTUFU	40.3674	168.405	118	4.16667	125	0.048780	102
126	47	NZKAINGR	39.6291	156.000	123	4.85714	115	0.074074	85

ing: fam... is sorted by mean DBH									12:02 MONESUAT, MAR 23, 1990 1	
OBS	FAM	ORIGIN	DBHRANK	DBHRANK	FORRANK	FORRANK	FLURRANK	FLURRANK		
1	104	NZOAKURA	227.054	1	5.70270	41	0.432432	12		
2	103	NZOAKURA	224.764	2	6.75676	2	0.351351	19		
3	125	NATAL	224.639	3	6.94444	1	0.200000	37		
4	2	UBERON	217.500	4	5.30000	73	0.075000	86		
5	4	UBERON	216.343	5	5.37143	68	0.114286	69		
6	9	UBERON	214.737	6	5.24324	79	0.157895	45		
7	116	BARRINGT	213.714	7	6.60000	4	0.023571	109		
8	68	TALLAGN	210.405	8	6.10811	29	0.216216	36		
9	22	ROSSI	210.273	9	3.78788	126	0.151515	51		
10	5	UBERON	209.487	10	6.23077	12	0.256410	29		
11	57	NZCHARIT	208.875	11	6.12500	18	0.875000	1		
12	139	NATAL	207.833	12	6.20633	14	0.375000	15		
13	58	UBERON	206.447	13	5.65789	43	0.054054	97		
14	117	BARKINGI	206.200	14	6.71429	3	0.000000	111		
15	99	NZOAKURA	204.893	15	5.46429	60	0.321429	3		
16	8	UBERON	203.828	16	6.20690	15	0.068966	87		
17	55	NZBROUGH	203.464	17	5.39206	66	0.333333	21		
18	94	NZWAINAN	201.250	18	4.85714	106	0.321429	24		
19	36	BUMBALA	200.000	19	6.18182	16	0.031250	104		
20	13	ROSSI	199.923	20	6.56000	5	0.230769	34		
21	6	UBERON	199.848	21	5.54545	54	0.135000	61		
22	64	YELTHOLM	199.412	22	5.17647	83	0.030303	107		
23	10	UBERON	199.056	23	5.97222	24	0.085714	80		
24	7	UBERON	197.194	24	5.00000	91	0.032258	103		
25	34	BUMBALA	195.926	25	5.92593	27	0.280000	27		
26	118	BARRINGT	195.588	26	5.64706	45	0.121212	64		
27	16	ROSSI	195.226	27	4.50065	110	0.000000	112		
28	122	BARRINGT	194.971	28	5.68571	42	0.114286	70		
29	124	NATAL	194.270	29	5.89189	28	0.109108	73		
30	3	UBERON	193.973	30	6.37636	10	0.027027	110		
31	114	BADJA	193.971	31	5.26471	77	0.470333	10		
32	11	UBERON	192.306	32	4.94444	98	0.111111	71		
33	98	NZOAKURA	191.552	33	6.03571	22	0.571429	7		
34	21	ROSSI	191.029	34	5.63636	46	0.151515	49		
35	15	ROSSI	190.571	35	5.88571	30	0.200000	38		
36	53	NZROTUFU	189.852	36	4.77778	107	0.851852	2		
37	126	NATAL	189.789	37	5.73684	38	0.421053	13		
38	121	BARRINGT	188.538	38	5.26923	75	0.115385	68		
39	45	ROBERTSON	188.471	39	5.58824	48	0.117647	65		
40	115	BARKINGI	187.378	40	6.48649	7	0.222222	35		
41	110	NZOAKURA	187.161	41	5.41935	64	0.500000	9		
42	105	NZOAKURA	186.259	42	5.55556	52	0.333333	22		
43	139	NZHUNTER	184.960	43	5.04000	90	0.000000	113		
44	84	NZROTUFU	184.885	44	6.46154	8	0.307692	25		
45	109	NZMANGAN	184.750	45	4.95833	96	0.125000	62		
46	17	ROSSI	184.706	46	5.70588	39	0.323529	23		
47	20	ROSSI	184.568	47	6.02703	23	0.109108	74		
48	152	BADJA	184.057	48	5.40000	65	0.057143	95		
49	80	BADJA	183.574	49	5.37500	67	0.062500	92		
50	91	NZIKITE	183.556	50	6.22222	13	0.000000	114		
51	72	TALLAGN	183.000	51	6.40741	9	0.192308	40		
52	106	NZOAKURA	182.806	52	4.93548	101	0.580645	6		
53	97	NZROTUFU	182.706	53	5.55892	51	0.352941	17		
54	74	VENDOC	182.212	54	5.78788	35	0.151515	50		
55	128	NATAL	181.926	55	5.74074	37	0.592593	4		

Table 16 - Kaingaroa families sorted by mean DBH

ORS	FAM	ORIGIN	DEBKAN	DEBKAN	DEBKAN	EURKAN	EURKAN	EURKAN	EURKAN
56	146	NZCARRG	181.828	6.1724	6.1724	17	0.586207	5	5
57	107	NZAKURA	181.727	57	1.42424	115	0.156250	123	123
58	136	NZHUNTER	180.692	58	4.53846	111	0.000000	105	105
59	18	ROSSI	180.406	59	3.53125	55	0.031250	101	101
60	43	ROBERTS	180.296	60	3.25926	78	0.038462	101	101
61	39	ROBERTS	179.154	61	3.34615	69	0.15346	47	47
62	148	NZCARRG	178.971	62	3.76471	36	0.352941	18	18
63	42	ROBERTS	178.900	63	4.26667	119	0.133333	59	59
64	108	NZAKURA	178.895	64	3.43105	63	0.263158	28	28
65	149	NZCARRG	178.667	65	3.18182	91	0.393939	88	88
66	73	BERNOC	178.138	66	3.82729	34	0.068666	88	88
67	101	NZAKURA	178.061	67	3.18182	82	0.363636	16	16
68	138	NZHUNTER	177.750	68	3.07143	87	0.142857	53	53
69	12	ROSSI	177.462	69	3.46154	61	0.192308	53	53
70	24	ROSSI	177.222	70	3.70370	40	0.076923	82	82
71	141	NZHUNTER	177.172	71	4.44388	114	0.137931	56	56
72	23	ROSSI	177.167	72	3.26667	76	0.241379	30	30
73	69	TALVAN	177.193	73	3.55263	53	0.18211	43	43
74	44	ROBERTS	177.090	74	3.15789	84	0.105263	76	76
75	100	NZAKURA	176.900	75	3.46667	59	0.233333	33	33
76	26	BURBALA	176.588	76	4.94118	99	0.000000	116	116
77	92	NZTKLTR	176.348	77	3.32174	56	0.043478	100	100
78	33	BURBALA	176.261	78	3.86957	31	0.066957	78	78
79	119	BAKS INST	176.176	79	6.05882	106	0.029412	108	108
80	137	NZHUNTER	175.586	80	4.68966	106	0.137931	57	57
81	81	ROBERTS	175.529	81	3.00000	92	0.233294	32	32
82	123	NZNGHIN	174.900	82	4.90000	102	0.166667	44	44
83	112	NZIA (KUA	174.714	83	4.00000	123	0.153846	48	48
84	142	NZHUNTER	174.167	84	3.33333	71	0.000000	122	122
85	37	BURBALA	173.968	85	6.51613	6	0.064516	90	90
86	150	NZCARRG	173.133	86	4.63333	109	0.466667	11	11
87	19	ROSSI	172.917	87	3.88889	29	0.125000	63	63
88	135	NZAHADVA	172.875	88	3.50000	58	0.035556	96	96
89	14	ROSSI	171.697	89	4.96970	95	0.303030	26	26
90	54	ROBERTS	170.800	90	5.85000	32	0.000000	115	115
91	111	BERNOC	170.769	91	4.84462	104	0.000000	115	115
92	41	ROBERTS	170.600	92	6.33333	11	0.133333	58	58
93	30	BURBALA	170.400	93	4.86667	105	0.034483	102	102
94	60	BURBALA	169.939	94	3.57576	50	0.062500	93	93
95	27	BURBALA	169.889	95	3.32258	72	0.000000	119	119
96	140	NZHUNTER	169.656	96	4.21875	120	0.031250	106	106
97	144	NZHUNTER	168.522	97	3.00000	93	0.036957	79	79
98	52	NZKUTURU	167.875	98	4.93750	100	0.000000	121	121
99	88	NZKUTURU	167.667	99	4.50000	112	0.083333	81	81
100	38	ROBERTS	167.571	100	4.07143	122	0.142857	54	54
101	25	BURBALA	167.097	101	4.58865	49	0.000000	117	117
102	96	NZKUTURU	166.000	102	4.30769	117	0.192308	42	42
103	29	BURBALA	165.143	103	3.50000	57	0.000000	120	120
104	147	NZCARRG	165.034	104	3.62069	47	0.344828	20	20
105	127	NATAL	164.778	105	3.44444	62	0.355556	8	8
106	46	ROBERTS	164.150	106	4.95000	97	0.150000	52	52
107	120	BAKS INST	163.923	107	3.34615	70	0.000000	124	124
108	40	ROBERTS	163.100	108	3.30000	74	0.000000	125	125
109	90	NZTKLTR	162.500	109	6.11111	44	0.105263	75	75
110	31	BURBALA	161.700	110	3.65000	44	0.105263	75	75

Kaingaroa families sorted by mean dbh

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OBS	FAM	ORIGIN	DBHKN	DBHKANK	FORKN	FORKNANK	FLKN	FLKNANK
111	113	ROBERTSN	160.300	111	4.50000	113	0.100000	77
112	63	ROBERTSN	160.706	112	4.11765	121	0.056624	94
113	102	NZDAKURA	158.476	113	4.33333	116	0.233025	31
114	29	BOMBALA	157.950	114	5.85000	33	0.052632	98
115	48	NZKANGR	157.300	115	5.06667	89	0.133333	60
116	85	NZPOTORU	156.000	116	5.06667	88	0.066667	89
117	32	BOMBALA	155.323	117	5.12903	93	0.063516	91
118	35	BOMBALA	154.462	118	5.23077	80	0.076923	83
119	87	NZPOTORU	152.332	119	3.94118	125	0.117647	67
120	51	NZKANGR	140.400	120	5.00000	94	0.000000	126
121	143	NZHUNTER	145.526	121	4.89474	103	0.052632	99
122	83	NZHEATHC	144.000	122	5.10000	86	0.200000	39
123	89	NZTIKIR	142.308	123	5.96154	25	0.076923	84
124	50	NZKANGR	141.667	124	4.20571	118	0.142857	55
125	49	NZKANGR	134.647	125	5.94118	26	0.117647	66
126	47	NZKANGR	130.538	126	4.00000	124	0.076923	85

Table 17 - Kinleith families sorted by mean DBH

OBS	FAM	ORIGIN	INDICIN	DEHRAK	FORMIN	FORMBAM	FLPKIN	FLPKANK
1	110	NZAKUKA	256.080	1	5.29167	43	0.250000	13
2	103	NZAKUKA	253.310	2	6.68966	17	0.034463	26
3	19	SOSSI	246.387	3	6.45161	34	0.166667	90
4	104	NZAKUKA	244.333	4	5.033333	77	0.137931	38
5	125	NATAL	243.633	5	7.40000	30	0.071429	70
6	8	DEBUN	243.615	6	6.50000	30	0.043478	81
7	6	DEBUN	239.906	7	6.28125	15	0.100000	53
8	94	NZAKUKA	239.789	8	6.33333	41	0.105263	49
9	97	NZAKUKA	239.133	9	6.30000	42	0.100000	6
10	99	NZAKUKA	236.000	10	6.57143	25	0.555556	1
11	20	RUSSI	234.645	11	6.41935	35	0.250000	14
12	109	NZAKUKA	233.529	12	6.23529	48	0.235294	16
13	124	NATAL	233.091	13	6.13132	57	0.033333	94
14	12	RUSSI	232.174	14	5.85009	79	0.136364	40
15	4	DEBUN	231.545	15	5.66066	93	0.064516	74
16	2	DEBUN	229.889	16	6.88462	11	0.181818	23
17	68	TALAGAN	229.344	17	6.46875	32	0.031250	96
18	21	POSSI	229.094	18	6.06250	65	0.103448	50
19	18	RUSSI	227.758	19	6.04948	14	0.031250	97
20	23	RUSSI	226.828	20	6.10345	63	0.269231	9
21	14	RUSSI	226.333	21	6.24242	47	0.258065	12
22	7	DEBUN	225.065	22	5.74194	86	0.034463	91
23	36	BUMBALA	224.815	23	7.37037	2	0.000000	99
24	34	BUMBALA	224.348	24	6.21739	49	0.043478	82
25	98	NZAKUKA	223.714	25	6.64286	32	0.074074	67
26	5	DEBUN	222.500	26	6.20586	50	0.062500	76
27	152	KADJA	222.438	27	6.66667	19	0.062500	76
28	9	DEBUN	222.242	28	6.66667	74	0.068966	73
29	45	RUSSKISN	222.222	29	7.11111	5	0.111111	48
30	117	BARKINLT	221.853	30	7.29412	3	0.100000	52
31	106	NZAKUKA	220.346	31	5.33846	96	0.200000	75
32	58	DEBUN	220.188	32	6.03125	67	0.064516	79
33	22	RUSSI	220.034	33	4.75862	123	0.142857	34
34	81	RUSSKISN	219.833	34	5.83333	78	0.277778	8
35	115	BARKINLT	219.677	35	6.90323	10	0.000000	100
36	107	NZAKUKA	218.500	36	4.87097	119	0.133333	41
37	43	RUSSKISN	217.762	37	3.42857	104	0.250000	15
38	146	NZAKUKA	216.560	38	6.68000	18	0.136364	39
39	60	BUMBALA	216.296	39	6.18312	53	0.010000	86
40	13	POSSI	216.241	40	6.35172	27	0.064966	72
41	31	BUMBALA	215.710	41	6.70968	16	0.031483	92
42	64	YELTHULM	215.516	42	6.06452	64	0.000000	102
43	37	BUMBALA	215.232	43	6.85185	13	0.071074	68
44	69	TALAGAN	215.115	44	5.96154	69	0.040000	85
45	150	NZAKUKA	215.040	45	5.60000	94	0.030000	65
46	57	NZAKUKA	214.333	46	6.20000	51	0.538462	2
47	44	RUSSKISN	214.200	47	4.90000	113	0.150000	30
48	88	NZAKUKA	214.077	48	5.23077	110	0.083333	61
49	38	RUSSKISN	213.810	49	5.33810	108	0.150000	31
50	80	BARKINLT	213.697	50	6.03030	66	0.116250	29
51	105	NZAKUKA	213.600	51	5.61600	91	0.500000	3
52	126	NATAL	213.455	52	6.96970	9	0.281250	7
53	39	RUSSKISN	213.417	53	6.47836	31	0.090909	55
54	119	BARKINLT	213.125	54	6.37500	38	0.033256	95
55	17	SOSSI	213.103	55	5.86207	73	0.074074	69

Kinleith Families sorted by mean dip

OBS FAM ORIGIN ORIGIN ORIGIN ORIGIN ORIGIN ORIGIN ORIGIN ORIGIN

56 10 GERRON 212.036 56 7.07692 7 0.04000 84 0.00000 105 84

57 16 RUSSI 211.962 57 6.26923 44 0.00000 105 105

58 32 BOMBALA 211.621 58 7.10345 6 0.25925 11 11

59 148 NZCARBON 211.548 59 6.34839 38 0.12341 25 25

60 111 BENDOC 211.500 60 6.56667 26 0.14814 32 32

61 46 ROBERTSON 211.369 61 5.15385 112 0.12000 45 45

62 122 BARRINGTON 211.000 62 6.03333 66 0.00000 103 103

63 123 NZNGAHU 210.889 63 5.44444 102 0.08000 64 64

64 138 NZHUNTER 210.571 64 6.10714 62 0.12000 44 44

65 114 BADA 210.567 65 5.80000 80 0.14285 33 33

66 25 BOMBALA 209.938 66 6.34375 40 0.00000 112 112

67 116 BARRINGTON 209.343 67 6.65714 21 0.02941 98 98

68 15 RUSSI 208.613 68 7.03226 8 0.26667 10 10

69 42 ROBERTSON 208.591 69 5.45455 101 0.10000 54 54

70 26 BOMBALA 208.567 70 6.16667 53 0.00000 111 111

71 53 NZSOTOU 208.043 71 5.13043 115 0.36363 4 4

72 84 NZKOTOU 207.741 72 6.11111 61 0.23076 17 17

73 41 ROBERTSON 207.526 73 5.78947 84 0.21032 18 18

74 161 NZHUNTER 207.280 74 5.52600 98 0.00000 114 114

75 27 BOMBALA 207.115 75 5.92308 72 0.04000 87 87

76 144 NZHUNTER 206.920 76 5.44000 103 0.00000 117 117

77 137 NZHUNTER 206.826 77 5.17391 111 0.00000 116 116

78 113 ROBERTSON 206.778 78 5.61111 92 0.11764 46 46

79 140 NZHUNTER 206.433 79 4.91304 117 0.08693 58 58

80 74 BENDOC 205.563 80 6.87500 12 0.19364 20 20

81 24 RUSSI 204.615 81 6.15385 56 0.00000 108 108

82 73 BENDOC 204.500 82 6.12500 60 0.08333 59 59

83 139 NZHUNTER 203.650 83 5.80000 81 0.00000 109 109

84 128 NATAL 202.800 84 7.16000 4 0.06697 57 57

85 101 NZCARBON 202.462 85 5.72000 87 0.32000 5 5

86 149 NZCARBON 202.379 86 5.75667 85 0.14265 35 35

87 54 ROBERTSON 201.500 87 6.39889 37 0.17647 24 24

88 28 BOMBALA 201.318 88 6.54545 29 0.14265 36 36

89 11 UBERON 201.188 89 5.50000 99 0.00000 107 107

90 35 BOMBALA 200.852 90 6.40741 36 0.04000 88 88

91 143 NZHUNTER 200.105 91 5.36842 105 0.15795 28 28

92 96 NZBOTTO 199.680 92 5.48000 100 0.12500 43 43

93 108 NZCARBON 199.278 93 4.77778 120 0.06250 77 77

94 72 TALLAGN 198.800 94 6.16000 52 0.04347 83 83

95 55 NZBROUGH 198.647 95 5.94118 70 0.00000 104 104

96 127 NATAL 198.444 96 6.61111 23 0.18750 22 22

97 63 ROBERTSON 197.368 97 5.84211 76 0.05555 79 79

98 120 BARRINGTON 197.185 98 5.29636 107 0.00000 121 121

99 118 BARRINGTON 195.724 99 4.65517 123 0.00000 106 106

100 50 NZKALINDI 195.692 100 4.96154 116 0.04000 89 89

101 33 BOMBALA 195.464 101 5.64286 90 0.00000 113 113

102 100 NZCARBON 194.560 102 5.72000 88 0.16000 27 27

103 136 NZHUNTER 194.615 103 4.76923 121 0.00000 120 120

104 3 UBERON 194.176 104 6.45455 33 0.18750 21 21

105 30 BOMBALA 194.125 105 6.60370 24 0.04261 80 80

106 52 NZKOTOU 193.375 106 6.16667 54 0.00000 118 118

107 147 NZCARBON 192.963 107 6.25926 46 0.11385 47 47

108 29 BOMBALA 192.833 108 6.13333 59 0.10345 51 51

109 121 BARRINGTON 192.652 109 6.26687 45 0.00000 36 36

110 90 NZKALINDI 191.750 110 5.66667 89 0.00000 60 60

Kinleith families sorted by mean dbh

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OBS	FAM	ORIGIN	DBHKIN	DBHRANK	FORMKIN	FORMRANK	FLWKIN	FLWRANK
111	48	NZKAINGR	182.067	111	4.46667	124	0.076923	66
112	49	NZKAINGR	181.792	112	6.37500	39	0.003333	62
113	129	NATAL	181.733	113	6.66667	20	0.000000	101
114	92	NZTIKITE	179.200	114	5.80000	82	0.000000	115
115	87	NZROTURU	178.960	115	4.32000	123	0.000000	126
116	40	PUREPTSN	178.333	116	5.13333	114	0.000000	122
117	47	NZKAINGR	178.067	117	5.60000	93	0.071429	71
118	91	NZTIKITE	177.316	118	5.84211	75	0.000000	110
119	112	NZTAIRUA	175.857	119	4.14286	126	0.142857	37
120	85	NZROTUPU	174.333	120	5.93333	71	0.000000	123
121	142	NZHUNTER	169.857	121	6.14286	38	0.000000	119
122	89	NZTIKITE	164.588	122	6.29412	43	0.062100	78
123	102	NZDAKURA	162.643	123	5.33714	106	0.083333	63
124	83	NZHEATHC	158.231	124	5.53846	97	0.000000	125
125	51	NZKAINGR	153.118	125	5.23529	109	0.133333	42
126	135	NZAHAUPI	141.857	126	5.14286	113	0.000000	124

TABLE 18 - GAINS OF FAMILY SELECTION OF BEST 10, 15, 20 FAMILIES
AS COMPARED TO OVERALL MEAN

	Trait	
	DBH	Form
Overall mean $h_{\overline{F}}^2$ ⁽¹⁾	194.68 0.76	5.70 0.80
• Best 10 families		
Mean	222.14	6.48
Selection Differential	27.46	0.78
Gain	20.82	0.62
% Gain	10.7	10.9
• Best 15 families		
Mean	220.83	6.33
Selection Differential	26.15	0.63
Gain	19.87	0.50
% Gain	10.20	8.8
• Best 20 families		
Mean	217.60	6.31
Selection Differential	22.92	0.61
Gain	17.42	0.49
% Gain	8.9	8.6

(1) Sites considered to be random. $\sigma_{(fs)}^2 / 2$ component included in calculating $\sigma_{\overline{F}}^2$; considering sites to be fixed would marginally increase the $h_{\overline{F}}^2$ estimate for diameter from 0.76 $\rightarrow$ 0.81.

Table 19 - Plus tree candidates Kaingaroa ranked on index

DBS	seedlot	origin	family	rank	rep	sets	tree	index	dbh	form	flwr	fruitscore (fam)
1	103	NZOKKURA	2	21	41	3	39	12.0266	353.18	7.04	3	84
2	125	NATAL	1	41	29	1	40	12.0017	336.82	7.05	1	84
3	103	NZOKKURA	3	16	16	1	39	11.9309	387.90	5.86	0	84
4	116	BAKKINGT	9	16	3	1	21	11.8580	320.52	8.21	0	84
5	103	NZOKKURA	2	28	28	1	4	11.8504	309.87	9.10	0	84
6	103	NZOKKURA	3	31	31	3	3	11.8194	377.87	4.24	0	13
7	125	NATAL	1	31	31	2	7	11.7708	348.28	6.04	0	13
9	13	KOOSI	14	42	42	1	35	11.5737	362.30	6.98	1	53
10	36	BUMBALA	8	36	36	3	16	11.4847	348.97	7.86	1	53
11	57	NZCHARTY	16	24	34	1	40	11.4691	321.10	8.68	1	77
12	125	NATAL	1	33	33	3	29	11.4437	270.31	8.97	1	13
13	104	NZOKKURA	2	2	2	2	38	11.4249	301.41	8.41	0	65
14	104	NZOKKURA	3	4	4	2	24	11.3968	305.60	8.01	1	65
15	104	NZOKKURA	3	33	33	2	38	11.3732	304.31	7.97	2	65
16	104	NZOKKURA	3	24	24	2	18	11.3132	304.10	7.65	0	65
17	104	NZOKKURA	3	42	42	2	39	11.2962	330.30	5.98	3	65
18	125	NATAL	1	25	25	3	22	11.2680	251.04	9.27	0	13
19	104	NZOKKURA	3	3	20	2	40	11.2402	274.73	8.21	2	65
20	125	NATAL	1	20	20	3	11	11.2402	274.73	7.67	1	13
21	45	KOOSI	26	22	22	2	3	11.2162	353.34	8.21	1	119
22	103	NZOKKURA	2	1	1	1	10	11.2132	250.79	9.25	0	84
23	103	NZOKKURA	2	13	13	1	12	11.2054	268.49	8.12	0	84
24	125	NATAL	1	14	14	3	11	11.1819	263.78	8.05	0	13
25	10	OBERON	17	27	27	1	48	11.1761	323.44	7.64	0	23
26	129	NATAL	27	22	22	1	42	11.1517	286.34	9.21	1	58
27	4	OBERON	15	26	26	1	2	11.0950	308.36	7.85	0	8
28	116	BAKKINGT	9	3	3	1	6	11.0928	313.52	6.21	0	34
29	98	NZOKKURA	22	42	42	2	1	11.0478	328.30	7.98	3	90
30	103	NZOKKURA	2	14	14	1	13	11.0336	271.78	7.05	0	84
31	125	NATAL	1	13	13	3	19	11.0242	233.49	9.12	1	13
32	104	NZOKKURA	3	5	5	2	32	11.0139	262.69	8.23	3	65
33	103	NZOKKURA	2	17	17	1	11	11.0039	260.58	7.59	0	84
34	68	TALLAGN	7	26	26	1	14	10.9724	293.36	7.85	1	45
35	103	NZOKKURA	3	39	39	3	30	10.9891	268.29	7.04	2	84
36	55	NZOKKURA	43	18	18	1	1	10.9734	362.85	5.15	3	107
37	4	OBERON	15	16	16	1	4	10.9544	312.90	6.86	1	8
38	13	KOOSI	14	17	17	1	3	10.9415	300.58	7.59	1	58
39	125	NATAL	6	6	6	3	42	10.9359	239.30	8.92	0	13
40	103	NZOKKURA	3	22	22	1	41	10.9258	260.34	7.21	0	8
41	4	OBERON	15	12	12	1	17	10.9233	312.30	6.75	0	8
42	125	NATAL	1	12	12	2	41	10.9244	273.16	8.68	1	2
43	13	NZCHARTY	16	2	2	1	19	10.8949	278.41	8.41	2	13
44	57	NZCHARTY	16	18	18	1	27	10.8901	300.39	7.04	0	53
45	99	NZOKKURA	12	31	31	0	17	10.8897	301.37	6.22	3	43
47	125	NATAL	1	35	35	3	1	10.8544	232.98	8.91	0	12
48	105	NZOKKURA	55	27	27	3	20	10.8380	311.43	9.10	1	71
49	117	BAKKINGT	4	22	22	2	37	10.8354	284.34	7.21	0	18
50	125	NATAL	1	18	18	3	23	10.8351	219.29	9.04	0	12
51	117	BAKKINGT	4	1	1	2	41	10.8272	266.79	8.25	0	13
52	68	TALLAGN	7	27	27	1	41	10.8209	274.43	8.15	1	45
53	55	NZOKKURA	43	1	1	3	42	10.8085	282.79	9.25	1	107

Plus tree candidates Kaingaroa ranked on index
dbh and form adjusted for rep effects

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Plus tree candidates Kaingaroa ranked on index
dbh and form adjusted for rep effects

11:00 TUESDAY, JULY 17, 1990 2

ONS	seedlot	origin	family rank	rep	sets	tree	index	dbh 11	form 11	flur 11	frostscore (fan)
54	116	BARRINGT	9	8	1	42	10.8071	263.16	7.37	0	34
55	104	NZOAKURA	3	29	2	31	10.7929	289.52	5.95	0	65
56	2	UBERON	6	11	2	9	10.7839	297.96	6.90	0	5
57	125	NATAL	1	32	3	15	10.7821	231.44	8.64	0	12
58	5	UBERON	10	29	2	36	10.7756	256.52	8.95	0	3
59	72	TALLAGH	47	7	2	3	10.7738	327.53	7.00	2	89
60	116	BARRINGT	9	32	1	2	10.7650	263.44	7.64	0	34
61	58	UBERON	21	22	1	31	10.7556	268.34	9.21	0	17
62	57	NZCHARTER	16	6	1	22	10.7041	254.50	8.92	0	77
63	104	NZOAKURA	3	14	2	39	10.7031	296.78	5.05	0	65
64	103	NZOAKURA	2	30	1	11	10.6920	277.37	4.98	0	84
65	9	UBERON	13	12	3	15	10.6783	291.30	7.75	1	14
66	125	NATAL	1	4	3	27	10.6594	221.60	8.01	1	12
67	116	BARRINGT	9	30	1	8	10.6578	265.37	6.98	0	34
68	115	BARRINGT	18	15	3	26	10.6576	306.48	7.16	1	15
69	125	NATAL	1	5	3	22	10.6566	209.69	8.73	0	12
70	146	NZCAMBERG	33	3	3	14	10.6457	304.52	8.21	1	86
71	110	NZOAKURA	24	14	1	36	10.6451	298.78	9.05	2	92
72	58	UBERON	21	28	1	9	10.6399	276.87	8.10	0	17
73	104	NZOAKURA	3	10	2	17	10.6291	262.31	6.30	0	65
74	116	BARRINGT	9	9	1	17	10.6288	250.82	7.73	0	34
75	6	UBERON	11	33	3	35	10.6279	291.31	7.97	1	6
76	68	TALLAGH	7	9	1	27	10.6177	280.82	6.73	0	45
77	103	NZOAKURA	2	24	1	35	10.6133	227.10	7.68	0	84
78	103	NZOAKURA	2	23	1	18	10.5992	232.44	7.28	0	84
79	129	NATAL	27	6	1	36	10.5932	261.50	7.92	1	53
80	125	NATAL	1	23	3	33	10.5889	211.44	8.28	1	12
81	5	UBERON	10	28	2	2	10.5871	254.07	8.10	0	2
82	117	BARRINGT	4	35	2	9	10.5820	235.98	8.91	0	16
83	125	NATAL	1	22	3	17	10.5682	243.31	6.21	0	12
84	117	BARRINGT	4	28	2	7	10.5667	247.87	8.10	0	18
85	34	BOMBALA	23	42	1	39	10.5594	267.30	8.98	0	38
86	125	NATAL	1	24	3	25	10.5541	202.10	8.68	1	12
87	129	NATAL	27	31	1	21	10.5513	252.87	8.24	0	53
88	125	NATAL	1	11	3	21	10.5510	246.96	5.90	0	12
89	117	BARRINGT	4	33	2	31	10.5491	232.31	8.97	0	18
90	116	BARRINGT	9	22	1	35	10.5256	218.34	9.21	0	38
91	36	BOMBALA	8	26	3	2	10.5236	270.36	7.85	0	31
92	123	NZMAHIN	38	41	1	25	10.5224	369.18	6.04	2	110
93	4	UBERON	15	29	1	36	10.5218	243.52	8.95	1	8
94	104	NZOAKURA	3	34	2	7	10.5181	252.40	6.85	0	65
95	8	UBERON	5	34	2	13	10.5099	262.40	7.85	0	9
96	68	TALLAGH	7	32	1	41	10.5098	273.44	6.64	1	45
97	54	NZKOTURU	40	23	3	36	10.5051	280.14	8.28	3	47
98	125	NATAL	1	10	3	25	10.4950	195.31	8.80	0	12
99	104	NZOAKURA	3	39	2	17	10.4920	277.85	5.15	0	65
100	103	NZOAKURA	2	40	1	39	10.4881	240.53	6.22	0	84
101	36	BOMBALA	8	9	3	9	10.4793	284.82	6.73	0	31
102	103	NZOAKURA	2	11	1	13	10.4721	211.96	7.90	0	84
103	84	NZKOTURU	40	42	3	20	10.4711	266.30	8.93	0	49
104	125	NATAL	1	15	3	41	10.4652	219.48	7.16	1	12
105	9	UBERON	13	28	3	2	10.4590	273.87	7.10	0	14
106	116	BARRINGT	9	6	1	16	10.4579	217.50	8.92	0	34

Plus tree candidates Kaingaroa ranked on index
dbh and form adjusted for rep effects

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OBS	seedlot	origin	family rank	rep	sets	tree	index	dbh 11	form 11	flwr 11	freestore (fam)
107	9	UBERON	13	34	3	27	10.4574	248.10	8.68	0	14
108	125	NATAL	1	34	3	20	10.4544	207.40	7.85	0	12
109	103	NZOAKURA	2	32	1	28	10.4537	198.34	8.64	0	84
110	19	ROSSI	30	3	1	18	10.4518	309.52	8.21	0	21
111	68	TALLAGH	7	37	1	1	10.4393	263.93	6.87	2	45
112	74	BENDOC	44	15	3	42	10.4364	311.48	7.16	1	40
113	116	BARRINGT	9	13	1	39	10.4314	227.49	8.12	0	34
114	103	NZOAKURA	2	26	1	32	10.4155	224.36	6.85	0	84
115	116	BARRINGT	9	39	1	28	10.4139	258.85	6.15	0	34
116	37	BOMBALA	36	38	1	14	10.4120	325.37	6.07	0	48
117	8	UBERON	5	2	2	3	10.4107	261.41	7.41	0	9
118	8	ORLON	5	21	2	22	10.4026	258.64	7.54	0	9
119	21	ROSSI	31	29	3	36	10.3959	317.52	5.95	0	7
120	68	TALLAGH	7	34	1	35	10.3951	244.40	7.85	0	45
121	99	NZOAKURA	12	25	3	32	10.3914	293.04	6.27	2	43
122	103	NZOAKURA	2	20	1	2	10.3844	224.73	6.67	0	84
123	4	UBERON	15	20	1	34	10.3807	252.73	7.67	0	8
124	117	BARRINGT	4	40	2	19	10.3799	295.53	4.22	0	18
125	4	UBERON	15	35	1	34	10.3797	264.98	6.91	0	8
126	94	NZMAIHAN	19	31	2	17	10.3744	262.87	9.24	0	90
127	117	BARRINGT	4	23	2	40	10.3719	261.44	6.38	0	18
128	116	BARRINGT	9	28	1	33	10.3677	255.87	6.10	0	34
129	2	UBERON	6	40	2	3	10.3662	258.33	7.22	1	5
130	122	BARRINGT	38	15	1	7	10.3640	271.48	8.16	0	23
131	125	NATAL	1	1	3	20	10.3592	241.79	5.35	0	12
132	129	NATAL	27	14	1	41	10.3578	288.78	5.05	2	58
133	139	NZHUNTER	72	30	3	37	10.3493	336.37	5.98	0	91
134	16	ROSSI	50	30	1	39	10.3384	296.37	7.98	0	82
135	103	NZOAKURA	2	10	1	39	10.3374	186.31	8.80	0	84
136	55	NZKROUOH	43	2	3	41	10.3354	241.41	9.41	1	107
137	103	NZOAKURA	2	8	1	7	10.3316	217.15	6.87	0	84
138	103	NZOAKURA	2	41	1	25	10.3289	214.18	7.64	0	84
139	129	NATAL	27	28	1	40	10.3256	252.87	7.10	0	58
140	13	ROSSI	14	16	1	27	10.3251	261.90	6.86	0	58
141	146	NZCAMBERG	33	14	3	42	10.3216	296.78	7.05	1	86
142	103	NZOAKURA	2	25	1	11	10.3184	242.04	5.27	0	84
143	8	UBERON	5	11	2	41	10.3164	261.96	6.90	0	9
144	116	BARRINGT	9	33	1	12	10.3155	232.44	7.28	0	24
145	103	NZOAKURA	2	37	1	34	10.3110	247.93	4.87	0	34
146	6	UBERON	11	8	3	34	10.3107	283.16	6.87	0	6
147	5	UBERON	10	23	2	29	10.3097	245.44	7.28	1	2
148	7	UBERON	39	10	1	20	10.2878	331.31	4.80	0	20
149	104	NZOAKURA	3	1	2	3	10.3849	236.79	7.25	1	65
150	9	UBERON	13	13	3	33	10.3761	242.49	6.12	0	14
151	4	UBERON	15	17	1	41	10.3777	245.88	7.59	0	8
152	124	NATAL	20	5	2	4	10.3771	251.69	8.73	1	4
153	116	BARRINGT	9	5	1	13	10.3762	205.69	8.73	0	34
154	129	NATAL	27	26	1	40	10.3755	228.26	8.85	0	58
155	6	UBERON	11	40	3	16	10.2747	274.33	7.22	0	6
156	125	NATAL	1	28	3	19	10.2723	320.87	6.10	0	12
157	125	NATAL	1	9	3	39	10.2716	226.82	5.73	0	12
158	98	NZOAKURA	22	39	2	13	10.2680	377.85	7.15	2	90
159	3	UBERON	35	27	3	14	10.2641	298.43	5.15	0	1

Plus tree candidates Kaingaroa ranked on index
dbh and form adjusted for rep effects

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OBS	seedlot	origin	family rank	rep	sets	tree	index	dbh 11	form 11	flur 11	frostscore (fan)
160	81	ROBERTSON	71	33	2	19	10.2569	345.31	5.97	2	63
161	34	BOMBALA	23	1	1	39	10.2528	237.79	9.25	0	28
162	125	NATAL	1	2	3	30	10.2454	197.41	7.41	0	12
163	4	OBERON	15	28	1	10	10.2452	250.87	7.10	0	9
164	58	OBERON	21	4	1	8	10.2434	229.60	9.01	0	17
165	69	TALLAGN	57	21	2	3	10.2309	386.64	8.54	0	62
166	106	NZOAKURA	65	22	1	4	10.2255	328.34	6.21	1	108
167	57	NZCHARTR	16	4	1	4	10.2240	278.60	5.01	3	77
168	15	ROSSI	28	41	3	14	10.2173	264.18	8.04	0	51
169	100	NZOAKURA	85	34	1	26	10.2170	331.40	5.85	2	109
170	103	NZOAKURA	2	27	1	12	10.2168	219.43	6.15	2	84
171	68	TALLAGN	7	2	1	1	10.2133	220.41	8.41	0	45
172	8	OBERON	5	14	2	19	10.2097	250.78	7.05	0	9
173	8	OBERON	5	20	2	36	10.2042	272.73	5.67	1	9
174	72	TALLAGN	47	8	2	19	10.2039	299.16	5.87	0	89
175	57	NZCHARTR	16	25	1	4	10.2038	224.04	8.27	0	77
176	119	BARRINGT	46	9	1	30	10.2032	287.82	7.73	1	24
177	8	OBERON	5	37	2	22	10.2031	236.93	7.87	0	9
178	129	NATAL	27	13	1	27	10.2029	242.49	7.12	0	58
179	116	BARRINGT	9	29	1	39	10.2023	238.52	6.95	0	34
180	9	OBERON	13	35	3	5	10.2003	271.98	5.91	0	14
181	116	BARRINGT	9	2	1	26	10.1972	204.41	8.41	0	31
182	13	ROSSI	14	23	1	17	10.1952	244.44	7.20	1	53
183	103	NZOAKURA	2	19	1	39	10.1932	219.28	6.04	0	84
184	58	OBERON	21	10	1	21	10.1937	261.31	6.80	0	17
185	5	OBERON	10	42	2	33	10.1876	240.30	6.93	0	2
186	2	OBERON	6	3	2	25	10.1867	211.52	9.21	0	5
187	129	NATAL	27	27	1	35	10.1865	224.43	8.15	1	58
188	58	OBERON	21	7	1	26	10.1861	257.53	7.00	0	17
189	21	ROSSI	31	25	3	1	10.1850	295.04	6.27	0	7
190	2	OBERON	6	12	2	12	10.1850	251.30	6.75	1	5
191	103	NZOAKURA	2	4	1	23	10.1845	186.60	8.01	9	81
192	8	OBERON	5	13	2	22	10.1834	247.49	7.12	0	9
193	6	OBERON	11	11	3	33	10.1772	387.96	5.90	0	6
194	117	BARRINGT	4	39	2	34	10.1737	214.65	8.15	0	18
195	2	OBERON	6	13	2	17	10.1667	292.49	4.12	0	5
196	116	BARRINGT	9	39	1	35	10.1632	223.37	7.07	0	34
197	99	NZOAKURA	12	18	3	30	10.1593	245.29	8.04	1	43
198	5	OBERON	10	40	2	16	10.1563	282.53	4.22	0	2
199	116	BARRINGT	9	36	1	16	10.1562	209.97	7.86	0	34
200	116	BARRINGT	9	26	1	3	10.1496	193.36	8.85	0	34
201	104	NZOAKURA	3	23	2	37	10.1495	231.44	6.32	0	65
202	99	NZOAKURA	12	28	3	40	10.1483	275.87	6.10	1	43
203	117	BARRINGT	4	2	2	35	10.1467	208.21	8.41	0	18
204	104	NZOAKURA	3	35	2	40	10.1439	236.98	5.91	1	65
205	114	BADJA	51	8	2	42	10.1433	303.16	5.87	1	46
206	5	OBERON	10	18	2	3	10.1412	219.29	8.04	0	2
207	9	OBERON	13	6	3	18	10.1410	234.50	7.92	0	14
208	5	OBERON	10	26	2	19	10.1410	222.36	7.85	0	2
209	64	YELTHOLM	37	12	3	23	10.1408	296.30	5.75	0	26
210	58	OBERON	21	6	1	12	10.1371	303.50	3.92	0	17
211	5	OBERON	10	32	2	24	10.1370	225.44	7.64	0	2
212	10	OBERON	17	19	1	30	10.1309	241.23	8.04	0	22

Plus tree candidates Kaingaroa ranked on index
dbh and form adjusted for rep effects

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OBS	seedlot	origin	family rank	rep	sets	tree	index	dbh 11	form 11	flwr 11	frostscore (Tan)
213	115	BARRINGT	13	16	3	11	10.1303	231.90	7.86	0	15
214	2	OVERON	6	24	2	1	10.1303	379.10	1.68	0	5
215	84	NZROTOKU	40	24	3	2	10.1337	243.10	8.68	1	49
216	4	OVERON	15	14	1	24	10.1282	290.78	4.05	0	8
217	69	TALLAGN	57	22	2	30	10.1281	267.34	9.31	1	62
218	22	ROSSI	59	33	1	34	10.1240	304.31	5.97	0	47
219	9	OVERON	13	19	3	15	10.1227	247.38	7.04	0	14
220	68	TALLAGN	7	15	1	34	10.1197	265.40	5.16	0	45
221	53	NZROTOKU	78	25	1	24	10.1124	310.04	6.27	3	94
222	125	NATAL	1	3	3	20	10.1106	254.52	3.21	0	12
223	104	NZOAKURA	3	22	2	4	10.1082	310.34	1.21	0	65
224	68	TALLAGN	7	7	1	12	10.1064	234.53	7.00	0	45
225	36	BOMBALA	8	21	3	39	10.1035	289.64	4.54	0	31
226	5	OVERON	10	4	2	8	10.1024	216.60	8.01	0	2
227	124	NATAL	20	30	2	12	10.0947	281.37	5.98	0	4
228	7	OVERON	39	12	1	15	10.0919	332.30	3.75	0	20
229	55	NZBROUGH	43	19	3	10	10.0879	308.38	4.04	0	107
230	24	ROSSI	60	23	3	19	10.0860	275.44	8.28	0	52
231	5	OVERON	10	14	2	24	10.0853	230.78	7.05	2	2
232	149	NZCAMBRG	80	12	3	19	10.0811	325.30	5.75	2	60
233	36	BOMBALA	8	2	3	15	10.0767	208.41	9.41	0	31
234	8	OVERON	5	42	2	41	10.0700	224.39	7.90	0	0
235	3	OVERON	35	6	3	8	10.0702	302.50	3.92	0	1
236	116	BARRINGT	73	41	3	38	10.0701	249.18	8.04	0	35
237	58	OVERON	21	3	1	25	10.0690	244.52	7.31	1	17
238	2	OVERON	6	20	2	16	10.0684	291.73	3.67	0	5
239	36	BOMBALA	8	37	3	21	10.0682	248.93	6.87	0	31
240	68	TALLAGN	7	24	1	7	10.0678	204.10	8.68	0	45
241	2	OVERON	6	39	2	21	10.0663	218.85	8.15	0	5
242	55	NZBROUGH	43	9	3	8	10.0659	263.82	6.73	1	107
243	11	OVERON	70	41	2	31	10.0529	301.18	6.04	0	3
244	124	NATAL	20	26	2	18	10.0529	231.36	8.95	0	4
245	9	OVERON	13	42	3	41	10.0473	258.30	5.98	1	14
246	117	BARRINGT	4	18	2	26	10.0447	232.29	7.04	0	18
247	64	YELTHOLM	37	8	3	8	10.0342	253.16	7.87	0	26
248	58	OVERON	21	25	1	33	10.0328	273.04	5.27	0	17
249	2	OVERON	6	25	2	10	10.0295	295.04	3.27	0	5
250	103	NZOAKURA	2	33	1	32	10.0267	174.31	7.97	0	84
251	6	OVERON	11	31	3	13	10.0266	253.87	7.24	0	6
252	129	NATAL	27	34	1	14	10.0264	232.40	6.85	2	50
253	104	NZOAKURA	3	18	2	36	10.0242	241.29	5.04	1	65
254	122	BARRINGT	38	10	1	33	10.0223	249.31	7.80	0	23
255	68	TALLAGN	7	12	1	23	10.0175	231.30	6.75	0	45
256	125	NATAL	1	8	3	31	10.0173	236.16	3.87	0	12
257	125	NATAL	1	17	3	29	10.0158	246.58	3.59	0	12
258	84	NZROTOKU	40	5	3	40	10.0154	281.69	5.73	2	40
259	10	OVERON	17	13	1	7	10.0151	230.49	8.12	0	22
260	5	OVERON	10	5	2	36	10.0143	197.69	8.73	0	2
261	13	ROSSI	14	24	1	31	10.0141	223.10	7.68	0	53
262	36	BOMBALA	8	14	3	31	10.0138	257.78	6.05	0	31
263	125	NATAL	1	30	3	39	10.0134	185.37	6.98	0	12
264	45	ROBERTSON	26	3	2	32	10.0078	270.52	7.21	0	119
265	103	NZOAKURA	2	9	1	1	10.0070	192.82	6.73	0	84

Plus tree candidates Kaingaroa ranked on index
dbh and form adjusted for rep effects

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URS	seedlot	origin	family rank	rep	sets	tree	index	dbh 11	form 11	flwr 11	frostscore (fan)
266	10	OBERON	17	35	1	14	10.0011	248.98	6.91	0	22
267	4	OBERON	15	5	1	36	9.9933	268.69	4.73	2	3
268	117	BARRINGT	4	21	2	12	9.9922	193.64	8.54	0	18
269	9	OBERON	13	20	3	36	9.9912	238.73	5.67	0	14
270	106	NZOAKURA	65	41	1	28	9.9881	279.13	8.04	0	106
271	124	NATAL	20	33	2	11	9.9766	304.31	3.27	1	4
272	98	NZOAKURA	22	11	2	1	9.9758	257.96	6.90	1	90
273	104	NZOAKURA	3	12	2	29	9.9753	173.30	7.75	0	65
274	99	NZOAKURA	12	36	3	28	9.9734	232.97	7.86	1	43
275	5	OBERON	10	36	2	4	9.9712	256.97	4.86	0	2
276	118	BARRINGT	73	33	3	21	9.9650	220.44	9.28	.	35
277	99	NZOAKURA	12	17	3	11	9.9639	236.58	7.59	0	43
278	126	NATAL	29	9	1	39	9.9614	252.82	7.73	1	25
279	10	OBERON	17	41	1	18	9.9589	227.18	8.04	0	22
280	94	NZMANGAN	19	22	2	8	9.9566	245.34	8.21	0	99
281	72	TALLAGH	47	23	2	11	9.9553	233.14	9.28	1	89
282	15	ROSSI	28	29	3	27	9.9540	276.52	5.95	0	51
283	3	OBERON	35	3	3	25	9.9533	239.52	7.21	0	1
284	117	BARRINGT	4	27	2	27	9.9490	196.43	8.15	0	18
285	5	OBERON	10	16	2	4	9.9488	238.90	5.06	0	2
286	3	OBERON	35	28	3	8	9.9479	240.87	7.10	0	1
287	148	NZCAMBERG	45	11	2	10	9.9437	281.96	6.90	1	66
288	68	TALLAGH	7	5	1	9	9.9395	257.69	4.73	0	45
289	99	NZOAKURA	12	34	3	13	9.9372	246.40	6.85	0	43
290	105	NZOAKURA	55	24	3	15	9.9367	310.10	4.68	3	71
291	57	NZCHARTER	16	27	1	5	9.9352	236.43	6.15	2	77
292	68	TALLAGH	7	28	1	14	9.9351	218.87	7.10	1	45
293	103	NZOAKURA	2	7	1	34	9.9349	182.53	7.00	1	84
294	108	NZOAKURA	94	2	3	9	9.9314	280.41	7.41	1	114
295	4	OBERON	15	39	1	17	9.9292	272.85	4.15	0	8
296	103	NZOAKURA	2	16	1	39	9.9277	232.90	3.86	0	84
297	68	TALLAGH	7	23	1	20	9.9233	247.33	5.28	1	45
298	92	NZTRITE	97	30	1	40	9.9224	272.37	7.98	1	105
299	117	BARRINGT	4	9	2	30	9.9194	200.82	7.73	0	18
300	2	OBERON	6	21	2	27	9.9185	216.64	7.54	0	5
301	125	NATAL	1	19	3	37	9.9182	225.38	4.04	0	12
302	5	OBERON	10	33	2	35	9.9174	218.31	6.97	0	2
303	125	NATAL	1	37	3	23	9.9169	227.93	3.87	0	12
304	34	BUNIKALA	23	34	1	6	9.9165	265.40	5.85	0	28
305	13	ROSSI	14	41	1	34	9.9155	209.18	8.04	0	53
306	3	OBERON	35	11	3	9	9.9150	208.76	8.99	0	1
307	72	TALLAGH	47	2	2	12	9.9141	250.41	7.41	0	89
308	58	OBERON	21	30	1	10	9.9118	235.37	6.98	0	17
309	125	NATAL	1	16	3	37	9.9107	178.70	6.86	0	12
310	117	BARRINGT	4	16	2	11	9.9095	197.90	7.86	0	18
311	3	OBERON	35	26	3	10	9.9044	241.36	6.85	0	1
312	152	BAUJA	48	9	2	18	9.9021	264.82	7.73	0	38
313	68	TALLAGH	7	22	1	30	9.9017	214.34	7.21	0	45
314	5	OBERON	10	38	2	9	9.8985	231.37	6.07	1	2
315	68	TALLAGH	7	3	1	2	9.8955	262.52	4.21	1	45
316	15	ROSSI	28	18	3	27	9.8892	237.29	8.04	0	51
317	15	ROSSI	28	33	3	37	9.8878	238.31	7.97	0	51
318	109	NZMANGAN	41	1	1	35	9.8870	263.79	8.25	0	121

Plus tree candidates Kaingaroa ranked on index
dbh and form adjusted for rep effects

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OBS	seedlot	origin	family rank	rep	sets	tree	index	dbh 11	form 11	flwr 11	frostscore (raw)
319	36	BOMBALA	8	12	3	11	9.88471	268.30	4.75	0	31
320	104	NZOAKURA	3	8	2	15	9.88193	216.16	5.87	0	65
321	11	OVERON	70	7	2	9	9.88126	271.33	7.00	0	3
322	104	NZOAKURA	3	28	2	13	9.87894	269.87	3.10	0	65
323	116	BARRINGT	9	18	1	35	9.87852	184.29	8.04	0	34
324	58	OVERON	21	41	1	3	9.86979	247.18	6.04	0	17
325	23	ROSSI	53	10	2	41	9.86730	291.31	6.80	2	29
326	57	NZCHARTP	16	7	1	22	9.86355	200.53	8.00	0	77
327	122	BARRINGT	38	21	1	32	9.86221	256.64	6.54	0	23
328	116	BARRINGT	9	21	1	18	9.85979	174.64	8.54	0	34
329	5	OVERON	10	21	2	29	9.85785	236.64	5.54	0	2
330	125	NATAL	1	21	3	19	9.85639	179.64	6.54	0	12
331	11	OVERON	70	12	2	31	9.85615	257.30	7.75	0	3
332	8	OVERON	5	24	2	27	9.85414	260.10	4.68	0	9
333	36	BOMBALA	8	30	3	7	9.85410	213.37	7.98	0	31
334	40	ROBERTSN	113	26	1	5	9.85228	295.36	7.85	0	95
335	72	TALLAGN	47	4	2	4	9.85232	235.60	8.01	0	89
336	10	OVERON	17	1	1	5	9.85034	279.79	4.25	0	22
337	117	BARRINGT	4	29	2	15	9.84952	191.52	7.95	0	18
338	2	OVERON	6	14	2	18	9.84861	283.70	3.05	0	5
339	115	BARRINGT	18	41	3	30	9.84658	258.18	6.04	0	15
340	99	NZOAKURA	12	21	3	21	9.84498	227.64	7.54	0	48
341	114	BADJA	51	30	2	30	9.84382	244.37	7.98	1	46
342	105	NZOAKURA	55	41	3	26	9.84097	280.18	6.04	0	71
343	2	OVERON	5	28	2	30	9.83420	216.87	7.10	0	5
344	116	BARRINGT	9	24	1	11	9.83313	235.10	4.66	1	34
345	124	NATAL	20	14	2	3	9.82920	209.78	9.05	0	4
346	3	OVERON	35	22	3	31	9.82906	229.34	7.21	0	1
347	9	OVERON	13	9	3	22	9.82773	276.82	3.73	0	14
348	4	OVERON	15	25	1	9	9.82670	239.04	6.27	0	8
349	2	OVERON	6	16	2	29	9.82645	203.90	7.86	0	5
350	118	BARRINGT	73	1	3	22	9.82630	225.79	8.25	0	35
351	126	NATAL	29	14	1	11	9.82627	252.78	7.05	0	25
352	84	NZKOTOKU	40	12	3	39	9.82501	233.30	7.75	0	49
353	121	BARRINGT	63	41	3	38	9.82416	265.18	7.04	0	39
354	11	OVERON	70	29	2	29	9.82244	267.52	6.95	1	3
355	58	OVERON	21	18	1	14	9.82233	243.29	6.04	0	17
356	104	NZOAKURA	3	40	2	28	9.81875	221.59	5.22	0	65
357	135	NZAHAKURA	118	29	2	25	9.81859	270.52	7.95	0	87
358	55	NZBROUGH	49	7	3	8	9.81744	270.53	5.00	0	107
359	22	ROSSI	59	9	1	33	9.81706	366.82	6.73	2	47
360	117	BARRINGT	4	30	2	38	9.81423	204.37	6.98	0	18
361	5	OVERON	10	37	2	32	9.81413	243.23	4.87	1	2
362	91	NETIKITE	77	37	3	17	9.81118	253.93	6.87	0	117
363	125	NATAL	1	36	3	31	9.81118	186.97	5.86	0	12
364	13	ROSSI	14	37	1	29	9.80384	218.93	6.87	0	53
365	2	OVERON	6	4	2	12	9.80089	215.60	7.01	0	5
366	8	OVERON	5	35	2	34	9.80061	251.98	4.91	0	9
367	2	OVERON	6	6	2	8	9.79965	184.50	8.92	0	5
368	3	OVERON	35	41	3	36	9.79905	197.18	9.04	0	1
369	117	BARRINGT	4	24	2	37	9.79373	175.10	8.68	0	18
370	34	BOMBALA	23	16	1	10	9.79036	254.90	5.86	2	28
371	36	BOMBALA	8	6	3	39	9.78381	208.50	7.92	.	31

Plus tree candidates Kaingaroa ranked on index
dbh and form adjusted for rep effects

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DBS	seedlot	origin	family rank	rep	sets	tree	index	dbh 11	form 11	flwr 11	frostscore (fan)
372	34	BOMBALA	23	23	1	26	9.78250	247.44	6.28	1	20
373	116	BARRINGT	9	1	1	33	9.77980	172.79	8.25	0	34
374	4	OBERON	15	7	1	33	9.77922	230.53	6.00	0	8
375	104	NZOAKURA	3	32	2	7	9.77881	211.44	5.64	0	65
376	36	BOMBALA	8	1	2	39	9.77848	202.79	8.25	0	31
377	2	OBERON	6	37	2	36	9.77440	231.93	5.87	0	5
378	118	BARRINGT	73	4	3	20	9.77366	241.60	7.01	0	35
379	117	BARRINGT	4	12	2	3	9.77063	183.30	7.75	0	18
380	94	NZWALMAN	19	25	2	31	9.76963	229.04	8.27	0	99
381	2	OBERON	6	17	2	8	9.76909	203.58	7.59	0	5
382	5	OBERON	10	8	2	34	9.76813	240.16	4.87	2	2
383	19	ROSSI	30	22	1	1	9.76643	233.34	8.31	0	31
384	8	OBERON	5	9	2	22	9.76582	235.82	5.73	0	9
385	122	BARRINGT	38	34	1	22	9.76486	227.40	7.85	0	23
386	116	BARRINGT	9	19	1	33	9.76300	207.28	6.04	0	34
387	5	OBERON	10	12	2	17	9.76108	235.30	5.75	0	2
388	13	ROSSI	14	39	1	14	9.75970	210.85	7.15	0	53
389	72	TALLAGN	47	27	2	15	9.75587	225.43	8.15	0	89
390	57	NZCHARIE	16	11	1	30	9.75520	241.96	4.90	1	77
391	9	OBERON	13	36	3	8	9.75390	219.97	6.86	0	14
392	122	BARRINGT	38	16	1	14	9.75134	209.90	8.66	0	23
393	7	OBERON	39	20	1	36	9.75094	210.73	7.67	0	20
394	109	NZMANAGH	41	37	1	11	9.74964	274.93	6.87	6	131
395	103	NZOAKURA	2	2	1	34	9.74621	160.41	7.41	2	84
396	58	OBERON	21	36	1	8	9.74619	239.97	5.86	0	17
397	4	OBERON	15	34	1	13	9.74513	246.40	4.85	0	8
398	9	OBERON	13	37	3	40	9.73759	250.93	4.87	2	14
399	34	BOMBALA	23	2	1	15	9.73748	228.41	7.41	0	28
400	126	NATAL	29	34	1	3	9.73604	232.40	7.85	0	25
401	6	OBERON	11	22	3	12	9.73183	311.34	2.21	0	6
402	7	OBERON	39	14	1	19	9.72919	232.78	8.05	0	20
403	118	BARRINGT	73	7	3	38	9.72863	270.53	5.00	0	35
404	129	NATAL	27	5	1	18	9.72554	209.69	6.73	0	58
405	98	NZOAKURA	22	27	2	39	9.72323	249.43	6.15	2	90
406	34	BOMBALA	23	4	1	39	9.72160	230.60	7.01	0	28
407	64	YELTHOLM	37	4	3	9	9.72014	257.60	6.01	0	26
408	104	NZOAKURA	3	19	2	41	9.71906	216.28	5.04	0	65
409	103	NZOAKURA	2	38	1	34	9.71860	212.37	4.07	0	84
410	128	NATAL	42	40	3	40	9.71667	302.53	4.22	1	30
411	4	OBERON	15	15	1	16	9.71549	206.48	7.16	0	8
412	3	OBERON	35	4	3	19	9.71094	206.60	3.01	0	1
413	21	ROSSI	31	16	3	25	9.70896	278.90	4.86	3	7
414	5	OBERON	10	20	2	34	9.70829	254.73	3.67	0	2
415	10	OBERON	17	38	1	9	9.70818	222.37	7.07	0	22
416	5	OBERON	10	9	2	32	9.70806	188.82	7.73	0	2
417	98	NZOAKURA	22	21	2	34	9.70542	241.64	6.54	3	90
418	7	OBERON	39	27	1	23	9.70532	245.43	7.15	0	20
419	119	BARRINGT	46	39	1	3	9.70390	233.85	9.15	0	24
420	10	OBERON	17	22	1	22	9.70179	203.34	8.21	0	22
421	20	ROSSI	25	23	2	2	9.70086	208.14	9.38	0	10
422	6	OBERON	11	9	3	32	9.69985	267.82	4.79	1	6
423	10	OBERON	17	33	1	17	9.69984	223.31	6.97	0	22
424	18	ROSSI	34	24	3	15	9.69940	252.10	7.68	0	50

Plus tree candidates (candidates ranked on index
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URS	seedlot	origin	family	rep	sets	tree	index	dih	form	flwr	frostscore
425	114	BALIA	51	34	2	9	9.69864	250.40	6.85	2	46
426	4	OREKON	15	41	1	16	9.69187	255.18	4.02	0	8
427	115	BAKINGT	18	39	3	17	9.68693	210.85	8.15	1	15
428	105	NZOKURRA	55	1	3	35	9.68539	247.79	7.25	0	71
429	117	GARRINGT	4	26	2	16	9.68316	238.36	4.85	0	18
430	129	NATAL	27	8	1	21	9.68019	236.16	4.87	0	58
431	64	YELTHOLM	37	19	3	39	9.67997	236.28	4.04	0	26
432	125	NATAL	1	27	3	13	9.67901	171.43	6.15	0	12
433	2	OREKON	6	26	2	9	9.67808	124.36	5.85	0	5
434	34	KOMBALA	22	25	1	7	9.67804	239.04	6.27	0	28
435	115	BAKINGT	18	40	3	34	9.67629	257.53	5.22	2	15
436	118	BAKINGT	73	42	3	30	9.67586	250.30	5.98	0	35
437	117	BAKINGT	4	6	2	2	9.67533	161.50	8.92	0	18
438	16	ROSSI	50	15	1	31	9.67440	271.45	6.16	0	82
439	115	BAKINGT	18	21	3	12	9.67339	219.64	7.54	0	15
440	20	ROSSI	25	25	2	25	9.66680	222.04	8.27	0	10
441	4	OREKON	15	1	1	9	9.66659	184.79	8.25	0	8
442	115	BAKINGT	18	37	3	19	9.66627	222.92	6.87	0	15
443	19	ROSSI	30	35	1	42	9.66604	249.98	7.91	0	21
444	117	BAKINGT	4	32	2	12	9.66516	181.44	7.64	0	18
445	171	ROSSI	52	8	2	22	9.66083	251.16	6.87	0	61
446	74	BENNOC	44	2	3	40	9.66049	228.41	8.41	0	40
447	110	NZOKURRA	24	31	1	17	9.66001	279.87	5.24	0	92
448	36	KOMBALA	8	39	3	31	9.65902	210.35	7.15	0	21
449	55	NZKROUGH	43	5	3	18	9.65893	245.69	5.73	0	107
450	2	OREKON	6	31	2	30	9.65832	248.87	4.24	0	5
451	58	OREKON	23	23	1	5	9.65768	193.44	8.28	0	17
452	129	NATAL	27	18	1	38	9.65724	215.29	6.04	0	58
453	68	TALLAGH	7	33	1	36	9.65577	214.31	5.97	0	45
454	116	BAKINGT	33	9	1	9	9.65571	248.31	2.97	0	34
455	138	NZKROUGH	69	19	2	23	9.65374	273.28	7.04	0	78
456	9	OREKON	13	5	3	3	9.65154	213.69	6.73	0	14
457	64	YELTHOLM	37	32	3	17	9.65032	235.14	7.64	0	26
458	68	TALLAGH	7	14	2	7	9.64735	244.78	4.05	0	45
459	141	NZKROUGH	93	4	2	6	9.64532	271.60	8.01	0	118
460	115	BAKINGT	18	12	3	3	9.64432	246.30	5.75	0	15
461	5	OREKON	10	2	1	21	9.63970	188.41	7.41	0	2
462	57	NZCHART	16	1	1	4	9.63663	243.79	4.25	0	77
463	103	NZOKURRA	2	34	1	17	9.63621	232.40	2.85	0	84
464	7	OREKON	39	33	1	13	9.63541	291.31	3.97	0	20
465	55	NZKROUGH	43	8	3	5	9.63119	225.16	6.87	1	107
466	80	KALJA	56	24	1	15	9.63032	252.40	6.85	0	26
467	109	NZKROUGH	41	38	1	6	9.63005	277.87	6.10	0	121
468	2	OREKON	6	35	2	8	9.63093	251.95	3.91	0	5
469	4	OREKON	15	2	1	21	9.62994	195.41	7.41	0	8
470	57	NZCHART	16	29	1	16	9.62833	214.52	5.95	2	77
471	27	KOMBALA	83	1	3	7	9.62631	258.29	8.25	0	27
472	100	NZOKURRA	85	29	1	38	9.62448	232.52	8.95	0	109
473	116	BAKINGT	9	15	1	6	9.62399	161.48	8.16	0	34
474	123	NZKROUGH	68	8	1	32	9.62328	258.16	5.87	0	110
475	68	TALLAGH	7	1	1	21	9.62047	271.79	2.25	0	45
476	10	OREKON	17	15	1	19	9.62034	197.48	8.16	0	22
477	106	NZOKURRA	65	37	1	38	9.61920	267.93	6.87	2	108

Plus tree candidates Kaingaroa ranked on index
dbh and form adjusted for rep effects

11:00 TUESDAY, JULY 17, 1990 10

OBS	seedlot	origin	family rank	rep	sets	tree	index	dbh 11	form 11	flwr 11	frostscore (1cm)
478	15	RUSSI	28	4	3	37	9.61864	215.69	8.01	1	51
479	94	NZWAIMAN	19	28	2	25	9.61850	251.87	6.10	0	99
480	6	ORERON	11	5	3	21	9.61846	228.69	6.73	0	6
481	5	ORERON	10	15	2	16	9.61836	174.48	8.16	0	2
482	9	ORERON	13	21	3	22	9.61611	197.64	7.54	0	14
483	114	BADJA	51	26	2	33	9.61055	227.36	7.85	0	46
484	55	NZBROUGH	43	17	3	13	9.60827	227.58	6.59	1	107
485	117	BARRINGT	4	4	2	20	9.60617	170.60	8.01	0	18
486	104	NZUAKURA	3	6	2	29	9.60318	192.50	5.92	0	65
487	55	NZBROUGH	43	16	3	30	9.60184	238.90	5.86	1	107
488	149	NZCAMBERG	80	18	3	15	9.60164	281.29	6.04	1	60
489	69	TALLAGH	57	36	2	8	9.60010	245.97	7.86	1	62
490	118	BARRINGT	73	30	3	35	9.59972	195.37	8.98	0	35
491	68	TALLAGH	7	21	1	2	9.59996	216.64	5.54	0	43
492	99	NZUAKURA	12	23	3	18	9.59306	227.44	6.28	1	43
493	34	BOMBALA	23	9	1	9	9.59284	240.82	5.73	0	29
494	3	ORERON	35	2	3	12	9.59172	190.41	8.41	0	1
495	152	BADJA	48	23	2	10	9.59157	230.44	8.28	0	38
496	5	ORERON	10	39	2	16	9.59079	204.85	6.15	0	2
497	43	ROBERTSON	67	27	3	31	9.58665	241.43	8.15	0	103
498	681	TALLAGH	7	4	1	5	9.58463	191.60	7.01	0	45
499	114	BADJA	51	27	2	1	9.58361	301.43	3.15	1	46
500	116	BARRINGT	9	27	1	1	9.58301	239.43	3.15	0	34

Plus tree candidates Kinleith ranked on index
dbh and form adjusted for rep effects

10:05 TUESDAY, JULY 17, 1990 1

OBS	seedlot	origin	family rank	rep	sets	tree	index	dbh 11	form 11	flwr 13	frostscore (fam)
1	125	NATAL	1	5	3	42	9.98791	353.46	9.36	0	12
2	125	NATAL	1	13	3	19	9.86997	361.22	8.41	0	12
3	125	NATAL	1	1	3	20	9.82969	334.42	9.20	0	12
4	8	OVERON	5	18	2	39	9.60979	365.69	8.25	0	9
5	110	NZOAKURA	24	10	1	30	9.60625	302.01	7.69	2	92
6	103	NZOAKURA	2	20	1	2	9.57775	345.98	7.68	0	84
7	19	ROSSI	30	23	1	2	9.57721	327.62	9.35	0	21
8	110	NZOAKURA	24	2	1	27	9.55219	338.12	9.05	0	92
9	103	NZOAKURA	2	15	1	38	9.55012	327.71	8.21	0	84
10	103	NZOAKURA	2	9	1	7	9.50184	362.30	6.64	0	84
11	125	NATAL	1	7	3	27	9.47610	297.22	8.64	0	12
12	125	NATAL	1	29	3	34	9.38008	277.55	8.85	0	12
13	125	NATAL	1	24	3	25	9.37710	285.04	8.55	0	12
14	103	NZOAKURA	2	34	1	39	9.36689	363.86	5.83	0	84
15	8	OVERON	5	25	2	22	9.36322	302.21	9.28	1	9
16	19	ROSSI	30	24	1	41	9.35471	316.04	8.55	0	21
17	36	BOMBALA	8	20	3	1	9.30564	314.98	8.68	0	31
18	94	NZWAIMAN	19	10	2	37	9.29909	377.01	6.69	0	99
19	125	NATAL	1	15	3	41	9.29082	254.91	9.21	0	12
20	6	OVERON	11	22	3	12	9.28836	265.12	10.13	0	6
21	99	NZOAKURA	12	27	3	12	9.23462	314.67	8.63	.	43
22	8	OVERON	5	20	2	36	9.20914	268.90	9.68	.	9
23	125	NATAL	1	16	3	37	9.19344	280.23	7.71	0	12
24	125	NATAL	1	14	3	11	9.17768	228.23	9.59	0	12
25	104	NZOAKURA	3	12	2	17	9.16560	306.09	9.05	0	65
26	103	NZOAKURA	2	14	1	13	9.16108	234.23	9.59	0	84
27	117	BARRINGT	4	2	2	15	9.14891	292.12	9.05	0	18
28	125	NATAL	1	36	3	27	9.14880	239.31	9.01	0	12
29	125	NATAL	1	28	3	19	9.14843	273.61	7.71	.	12
30	125	NATAL	1	3	3	22	9.14535	248.58	8.64	0	12
31	125	NATAL	1	32	3	20	9.14334	302.46	6.59	0	12
32	103	NZOAKURA	2	6	1	33	9.13595	307.70	6.67	0	84
33	2	OVERON	6	22	2	31	9.13104	387.12	9.13	1	5
34	19	ROSSI	30	13	1	1	9.13067	313.22	7.41	2	21
35	6	OVERON	11	32	3	9	9.12274	281.46	8.59	0	6
36	103	NZOAKURA	2	26	1	32	9.12066	255.77	8.55	0	84
37	103	NZOAKURA	2	30	1	11	9.12063	300.69	6.85	0	84
38	6	OVERON	11	1	3	9	9.10678	289.42	8.20	1	6
39	94	NZWAIMAN	19	13	2	4	9.10640	303.22	8.41	1	99
40	8	OVERON	5	1	2	3	9.09967	318.42	7.20	0	9
41	103	NZOAKURA	2	13	1	12	9.08497	254.22	8.41	0	84
42	9	OVERON	13	24	3	27	9.07937	321.04	8.55	0	14
43	20	ROSSI	25	22	2	1	9.07888	288.12	9.13	1	10
44	15	ROSSI	28	1	3	30	9.07471	318.42	9.20	0	51
45	117	BARRINGT	4	11	2	12	9.06979	313.54	7.61	0	13
46	125	NATAL	1	25	3	22	9.06744	220.21	9.28	0	12
47	19	ROSSI	30	14	1	27	9.04649	243.23	9.59	0	21
48	125	NATAL	1	31	3	23	9.04010	250.28	7.99	1	12
49	6	OVERON	11	8	3	34	9.03609	310.40	6.71	0	6
50	97	NZROTUPU	32	13	1	4	9.02541	294.22	8.41	0	74
51	36	BOMBALA	8	14	3	31	9.01916	275.23	8.59	.	31
52	110	NZOAKURA	24	16	1	41	9.01684	321.23	6.71	1	92
53	99	NZOAKURA	12	1	3	10	9.01675	320.42	7.20	1	43

Table 20 - Plus tree candidates Kinleith ranked on index

Plus tree candidates Kinleith ranked on index
dbh and form adjusted for rep effects

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OBS	seedlot	origin	family rank	rep	sets	tree	index	dbh 11	form 11	flwr 11	frostscore (fan)
54	103	NZOAKURA	2	19	1	38	9.01603	304.07	6.14	0	84
55	58	OBERON	21	9	1	37	9.01412	367.30	7.64	0	17
56	103	NZOAKURA	2	7	1	1	9.01170	290.22	6.64	0	84
57	103	NZOAKURA	2	27	1	12	9.00906	263.67	7.63	0	84
58	110	NZOAKURA	24	31	1	12	9.00530	259.28	8.99	0	92
59	104	NZOAKURA	3	5	2	32	9.00332	300.46	8.36	0	65
60	19	ROSSI	30	21	1	8	8.99215	242.11	9.33	0	21
61	109	NZMANGAM	41	35	1	42	8.96973	319.60	6.93	0	121
62	36	BOMBALA	8	34	3	37	8.96846	287.86	7.83	0	31
63	19	ROSSI	30	11	1	6	8.96189	309.54	6.61	0	21
64	36	BOMBALA	8	27	3	4	8.96134	265.67	8.69	0	31
65	20	ROSSI	25	25	2	25	8.95684	366.21	9.38	0	10
66	19	ROSSI	30	32	1	19	8.95385	282.46	7.59	0	21
67	8	OBERON	5	21	2	32	8.95333	367.11	8.33	0	9
68	125	NATAL	1	11	3	41	8.95318	247.54	7.61	0	13
69	104	NZOAKURA	3	6	2	29	8.95186	334.70	8.67	0	65
70	19	ROSSI	30	26	1	1	8.95167	256.77	8.55	0	21
71	36	BOMBALA	8	15	3	10	8.95160	348.91	9.21	0	31
72	99	NZOAKURA	12	20	3	2	8.94652	270.98	8.69	1	43
73	97	NZROTORU	32	8	1	37	8.92904	351.40	5.71	3	74
74	20	ROSSI	25	18	2	42	8.92852	315.69	7.25	3	10
75	13	ROSSI	14	18	1	27	8.92737	298.60	9.25	2	53
76	2	OBERON	6	21	2	27	8.92511	251.11	9.33	1	5
77	109	NZMANGAM	41	30	1	42	8.92487	309.69	7.85	0	121
78	6	OBERON	11	20	3	34	8.92195	275.98	7.68	.	6
79	125	NATAL	1	12	3	25	8.91069	256.09	7.05	0	13
80	126	NATAL	29	11	1	21	8.90785	327.54	7.61	0	25
81	110	NZOAKURA	24	35	1	15	8.90249	298.60	6.93	0	92
82	74	BENDOC	44	20	3	18	8.89920	319.98	8.68	0	40
83	99	NZOAKURA	12	29	3	4	8.89454	364.55	4.85	1	43
84	18	ROSSI	34	18	3	34	8.89275	307.69	7.25	0	50
85	99	NZOAKURA	12	34	3	39	8.89206	311.86	6.83	2	43
86	19	ROSSI	30	25	1	3	8.89064	334.21	5.28	0	21
87	8	OBERON	5	5	2	34	8.88970	230.46	9.36	.	9
88	109	NZMANGAM	41	33	1	26	8.88582	326.41	7.00	3	121
89	20	ROSSI	25	17	2	20	8.88066	288.04	8.03	0	10
90	117	BARRINGT	4	34	2	19	8.88030	284.86	7.83	0	18
91	6	OBERON	11	27	3	30	8.87775	244.67	8.63	0	6
92	117	BARRINGT	4	5	2	3	8.87373	243.46	9.36	0	18
93	125	NATAL	1	22	3	17	8.87387	354.12	3.13	0	12
94	103	NZOAKURA	2	23	1	18	8.87000	256.62	7.35	0	84
95	104	NZOAKURA	3	31	2	10	8.86571	369.28	4.99	0	65
96	2	OBERON	6	4	2	12	8.86214	277.79	7.97	0	5
97	6	OBERON	11	15	3	16	8.85741	278.91	7.21	0	6
98	117	BARRINGT	4	17	2	6	8.85627	276.04	8.03	1	18
99	99	NZOAKURA	12	36	3	34	8.84876	274.31	8.01	0	43
100	36	BOMBALA	8	26	3	2	8.84575	435.77	1.55	0	31
101	16	ROSSI	50	18	1	34	8.84446	334.69	8.25	0	82
102	103	NZOAKURA	2	25	1	11	8.84404	407.21	1.28	0	84
103	45	ROBERTSON	26	31	2	5	8.84012	255.28	8.99	0	119
104	99	NZOAKURA	12	30	3	11	8.83909	250.69	8.85	0	43
105	6	OBERON	11	9	3	32	8.83634	317.30	5.64	0	6
106	115	BARRINGT	18	19	3	7	8.93114	291.07	8.14	0	15

Plus tree candidates Kinleith ranked on index
dbh and form adjusted for rep effects

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OBS	seedlot	origin	family rank	rep	sets	tree	index	dbh 11	form 11	flwr 11	frostscore (fan)
107	115	BARRINGT	18	23	3	40	8.82792	258.62	9.35	0	15
108	9	OBERON	13	15	3	21	8.82699	292.91	8.21	0	14
109	124	NATAL	20	2	2	2	8.82673	268.12	9.05	0	4
110	97	NZROTORU	32	9	1	27	8.82638	285.30	7.64	0	74
111	125	NATAL	1	4	3	27	8.82527	193.79	8.97	0	13
112	10	OBERON	17	23	1	28	8.82191	267.62	9.35	0	22
113	104	NZOAKURA	3	17	2	2	8.82076	388.04	4.03	0	65
114	103	NZOAKURA	2	29	1	40	8.82048	256.55	6.85	0	84
115	20	ROSSI	25	20	2	38	8.82026	261.98	8.68	.	10
116	12	ROSSI	49	12	3	31	8.81984	283.09	9.05	0	41
117	117	BARRINGT	4	33	2	34	8.81939	271.41	8.00	.	18
118	117	BARRINGT	4	27	2	27	8.81877	254.67	8.63	0	18
119	125	NATAL	1	33	3	20	8.81838	217.41	8.90	0	12
120	99	NZOAKURA	12	28	3	40	8.81729	277.61	7.71	1	43
121	20	ROSSI	25	30	2	3	8.81484	256.69	8.85	1	10
122	6	OBERON	11	33	3	9	8.80948	277.41	7.00	0	6
123	97	NZROTORU	32	27	1	10	8.80670	282.67	7.63	0	74
124	9	OBERON	13	16	3	9	8.80342	276.23	8.71	0	14
125	125	NATAL	1	10	3	21	8.80075	223.01	7.69	0	12
126	6	OBERON	11	2	3	8	8.79899	248.12	8.05	0	6
127	6	OBERON	11	3	3	21	8.79644	258.58	7.64	0	6
128	2	OBERON	6	24	2	1	8.79227	305.04	6.55	0	5
129	15	ROSSI	28	13	3	5	8.79149	271.22	9.41	1	51
130	6	OBERON	11	36	3	33	8.79019	274.31	7.01	0	6
131	36	BOMBALA	8	25	3	41	8.78942	323.21	9.28	0	31
132	32	BOMBALA	82	35	2	37	8.78942	326.60	6.93	3	68
133	14	ROSSI	61	25	2	3	8.78813	294.21	8.38	3	16
134	6	OBERON	11	17	3	41	8.78515	273.04	7.93	0	6
135	99	NZOAKURA	12	25	3	32	8.78390	231.21	9.28	0	43
136	110	NZOAKURA	24	7	1	24	8.78269	262.22	7.64	0	92
137	6	OBERON	11	28	3	36	8.78202	254.61	7.71	.	6
138	68	TALLAGH	7	17	1	37	8.77938	283.04	8.93	0	45
139	45	ROBERTSN	26	36	2	25	8.77692	298.31	7.01	1	119
140	19	ROSSI	30	33	1	27	8.77269	271.41	7.09	0	21
141	103	NZOAKURA	2	2	1	10	8.77189	244.12	7.05	0	84
142	19	ROSSI	30	34	1	24	8.76850	248.86	7.83	0	21
143	45	ROBERTSN	26	35	2	1	8.76841	325.60	5.93	0	119
144	94	NZWAINAN	19	18	2	24	8.76904	257.69	8.25	0	99
145	117	BARRINGT	4	26	2	16	8.76718	222.77	9.55	0	19
146	68	TALLAGH	7	5	1	5	8.76383	298.46	7.36	1	45
147	18	ROSSI	34	7	3	10	8.76244	278.22	7.64	0	50
148	8	OBERON	5	3	2	41	8.76213	283.58	6.64	0	9
149	21	ROSSI	31	25	3	1	8.76085	265.21	9.28	0	7
150	18	ROSSI	34	19	3	34	8.75897	298.07	9.14	0	50
151	99	NZOAKURA	12	18	3	30	8.75847	254.69	8.25	2	43
152	99	NZOAKURA	12	17	3	11	8.75632	313.04	6.03	2	43
153	103	NZOAKURA	2	36	1	28	8.75630	269.31	6.01	0	84
154	18	ROSSI	34	20	3	30	8.75440	275.98	7.68	0	50
155	2	OBERON	6	23	2	5	8.75247	251.62	8.35	.	5
156	152	HAUJA	48	20	2	10	8.74669	276.98	9.65	.	38
157	2	OBERON	6	27	2	14	8.73908	268.67	7.63	0	5
158	23	ROSSI	53	27	2	11	8.73687	308.67	7.63	0	29
159	6	OBERON	11	31	3	16	8.73489	240.28	7.99	0	6

Plus tree candidates Kinleith ranked on index
dbh and form adjusted for rep effects

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OBS	seedlot	origin	family rank	rep	sets	tree	index	dbh 11	form 11	flwr 11	freestore (Can)
160	6	OVERON	11	19	3	6	8.73422	289.07	6.14	2	6
161	128	NATAL	42	4	3	18	8.73190	381.79	8.97	.	36
162	18	ROSSI	34	29	3	41	8.73152	294.55	6.85	0	50
163	37	BOMBALA	36	14	1	6	8.73046	250.23	9.59	0	48
164	32	BOMBALA	82	13	2	34	8.72349	251.22	9.41	0	68
165	125	NATAL	1	30	3	39	8.72343	233.69	6.85	.	12
166	8	OVERON	5	8	2	36	8.72198	249.40	7.71	0	9
167	18	ROSSI	34	30	3	13	8.72177	266.69	7.85	0	50
168	2	OVERON	6	26	2	9	8.72143	241.77	8.55	0	5
169	146	NZCAMBERG	33	25	3	15	8.71718	287.21	8.28	0	86
170	148	NZCAMBERG	45	8	2	18	8.71531	345.40	6.71	0	66
171	68	TALLAGN	7	20	1	19	8.71507	329.98	9.68	0	45
172	6	OVERON	11	11	3	17	8.71208	220.54	8.61	0	6
173	126	NATAL	29	23	1	33	8.71107	252.62	9.35	1	25
174	6	OVERON	11	4	3	36	8.71047	210.79	8.97	0	6
175	117	BARRINGT	4	25	2	29	8.70905	274.21	7.28	0	18
176	117	BARRINGT	4	8	2	1	8.70891	236.40	8.71	0	18
177	126	NATAL	29	31	1	22	8.70627	314.38	6.99	1	25
178	103	NZOAKURA	2	11	1	13	8.70538	219.54	7.61	0	84
179	74	BENDOC	44	28	3	22	8.70387	270.61	8.71	.	40
180	36	BOMBALA	8	31	3	21	8.70378	218.28	8.99	0	31
181	13	ROSSI	14	7	1	14	8.69835	231.22	8.64	0	53
182	150	NZCAMBERG	89	31	1	31	8.69748	447.38	3.99	0	57
183	68	TALLAGN	7	6	1	27	8.69487	253.70	8.67	0	45
184	128	NATAL	42	34	3	40	8.69362	279.86	8.83	1	30
185	9	OVERON	13	36	3	41	8.69177	278.31	8.01	1	14
186	146	NZCAMBERG	33	23	3	13	8.69174	281.62	8.35	2	86
187	34	BOMBALA	23	23	1	26	8.69084	283.62	8.35	0	28
188	124	NATAL	20	1	2	4	8.68963	270.42	8.20	0	4
189	98	NZOAKURA	22	10	2	30	8.68878	284.01	7.69	0	90
190	124	NATAL	20	16	2	28	8.68868	283.23	7.71	0	4
191	8	OVERON	5	17	2	22	8.68864	236.04	8.93	0	9
192	8	OVERON	5	12	2	20	8.68577	235.09	8.05	0	9
193	103	NZOAKURA	2	35	1	25	8.68559	234.60	6.93	0	84
194	27	BOMBALA	83	14	3	10	8.68251	301.23	9.59	0	27
195	37	BOMBALA	36	35	1	9	8.68237	260.60	8.93	0	48
196	73	BENDOC	58	20	3	27	8.68138	295.98	9.68	0	19
197	98	NZOAKURA	22	14	2	37	8.67530	258.23	8.59	0	90
198	57	NZCHAUTE	16	17	1	32	8.67412	313.04	8.93	1	77
199	109	NZMANGAM	41	17	1	39	8.67399	368.04	8.93	1	121
200	117	BARRINGT	4	35	2	3	8.67211	251.69	7.93	0	18
201	20	ROSSI	25	2	2	17	8.67110	293.12	7.95	0	10
202	10	OVERON	17	13	1	7	8.67068	270.22	8.41	0	22
203	2	OVERON	6	8	2	37	8.66997	256.40	7.71	0	5
204	109	NZMANGAM	41	27	1	28	8.66760	277.67	7.63	0	121
205	99	NZOAKURA	12	8	3	7	8.66726	308.40	5.71	0	42
206	18	ROSSI	34	27	3	18	8.66460	237.67	9.63	0	50
207	19	ROSSI	30	17	1	20	8.66286	228.04	8.03	0	21
208	18	ROSSI	34	28	3	34	8.65917	287.61	6.71	.	50
209	110	NZOAKURA	24	13	1	6	8.65886	382.22	2.41	1	92
210	10	OVERON	17	31	1	23	8.65881	305.28	3.99	0	23
211	115	BARRINGT	18	26	3	39	8.65808	439.77	1.58	0	15
212	6	OVERON	11	7	3	33	8.65799	238.22	7.64	0	6

Plus tree candidates Kinleith ranked on index
dbh and form adjusted for rep effects

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OBS	seedlot	origin	family rank	rep	sets	tree	index	dbh 11	form 11	flur 11	frostscore (fam)
213	21	ROSSI	31	1	3	17	8.65760	331.42	6.20	1	7
214	5	OBERON	10	20	2	34	8.65669	300.98	7.68	.	2
215	19	ROSSI	30	9	1	11	8.65575	237.30	7.64	0	21
216	103	NZOAKURA	2	4	1	21	8.65327	228.79	6.77	0	84
217	94	NZWAIMAN	19	14	2	9	8.65231	390.23	2.59	1	99
218	19	ROSSI	30	10	1	27	8.65016	288.01	5.69	1	21
219	26	BOMBALA	76	19	2	9	8.64999	331.07	8.14	0	36
220	31	BOMBALA	66	24	1	42	8.64157	296.04	7.55	0	73
221	36	BOMBALA	8	36	3	4	8.64058	261.31	7.01	0	31
222	19	ROSSI	30	12	1	24	8.63960	224.09	8.05	0	21
223	8	OBERON	5	33	2	20	8.63526	255.41	7.00	0	9
224	19	ROSSI	30	36	1	31	8.63491	277.31	6.01	0	21
225	148	NZCAMBRG	45	21	2	13	8.63436	317.11	7.33	0	66
226	99	NZOAKURA	12	4	3	10	8.63404	243.79	7.97	0	43
227	36	BOMBALA	8	24	3	26	8.63378	246.04	7.55	0	31
228	97	NZROTORU	32	11	1	32	8.63232	257.54	7.61	0	74
229	13	ROSSI	14	17	1	3	8.62891	287.04	8.03	0	53
230	32	BOMBALA	82	15	2	36	8.62715	268.91	8.21	0	68
231	4	OBERON	15	21	1	29	8.62377	284.11	8.33	0	8
232	2	OBERON	6	35	2	12	8.61956	269.60	6.93	0	5
233	103	NZOAKURA	2	17	1	11	8.61816	222.04	7.03	0	84
234	98	NZOAKURA	22	21	2	34	8.61696	230.11	9.33	0	90
235	28	BOMBALA	86	31	1	13	8.61322	346.28	6.99	2	69
236	68	TALLAGN	7	30	1	20	8.61255	289.69	6.85	0	45
237	115	BARRINGT	18	24	3	37	8.61232	218.04	8.55	0	15
238	68	TALLAGN	7	31	1	1	8.61062	259.28	7.99	0	45
239	115	BARRINGT	18	7	3	32	8.60631	271.32	7.64	.	15
240	34	BOMBALA	23	34	1	37	8.60583	284.86	7.63	0	28
241	9	OBERON	13	3	3	3	8.60572	222.58	9.64	0	14
242	36	BOMBALA	8	1	3	39	8.60357	224.42	8.20	0	31
243	18	ROSSI	34	35	3	41	8.59664	272.60	6.93	0	50
244	5	OBERON	10	5	2	36	8.59565	300.46	7.36	0	2
245	125	NATAL	1	27	3	13	8.59436	220.67	6.63	0	12
246	110	NZOAKURA	24	22	1	13	8.59437	380.12	2.13	1	92
247	18	ROSSI	34	32	3	40	8.59189	254.46	7.59	0	50
248	117	BARRINGT	4	12	2	34	8.59110	210.09	9.05	0	18
249	99	NZOAKURA	12	22	3	41	8.59033	233.12	8.13	1	43
250	117	BARRINGT	4	7	2	30	8.58631	220.22	8.64	0	18
251	98	NZOAKURA	22	36	2	1	8.58512	260.31	8.01	0	90
252	14	ROSSI	61	22	2	2	8.58476	321.12	6.13	0	16
253	45	ROBERTSN	26	11	2	25	8.58430	280.54	6.61	0	119
254	41	ROBERTSN	64	22	3	15	8.58410	330.12	8.13	0	115
255	104	NZOAKURA	3	8	2	15	8.58301	282.40	6.71	0	65
256	5	OBERON	10	26	2	10	8.58040	266.77	8.55	0	3
257	9	OBERON	13	30	3	34	8.58010	239.69	8.85	0	14
258	104	NZOAKURA	3	26	2	30	8.57817	235.77	6.55	0	65
259	20	ROSSI	25	11	2	6	8.57059	253.54	7.61	.	10
260	32	BOMBALA	82	21	2	28	8.56897	257.11	8.33	0	68
261	109	NZMANGAM	41	7	1	26	8.56723	236.22	8.64	0	131
262	32	BOMBALA	82	2	2	8	8.56682	317.12	6.05	0	68
263	110	NZOAKURA	24	17	1	1	8.56595	220.04	8.03	0	92
264	39	ROBERTSN	54	9	3	42	8.56375	297.30	7.64	0	70
265	97	NZROTORU	32	3	1	7	8.56309	246.58	7.64	1	74

Plus tree candidates Kinleith ranked on index
dbh and form adjusted for rep effects

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OBS	seedlot	origin	family rank	rep	sets	tree	index	dbh 11	form 11	flwr 11	frost:score (fan)
266	117	BARRINGT	4	24	2	37	8.56211	219.04	8.55	0	18
267	104	NZOAKURA	3	23	2	37	8.56061	235.62	8.35	0	65
268	15	ROSSI	28	22	3	2	8.55979	218.12	10.13	0	51
269	34	BOMBALA	23	19	1	24	8.55706	243.07	9.14	0	23
270	37	BOMBALA	36	22	1	32	8.55675	316.12	6.13	0	48
271	39	ROBERTSN	54	35	3	42	8.55670	238.60	7.93	1	70
272	126	NATAL	29	36	1	42	8.55657	265.31	8.01	1	25
273	99	NZOAKURA	12	33	3	21	8.55525	231.41	8.00	0	43
274	6	OVERON	11	16	3	4	8.55504	221.23	7.71	0	6
275	21	ROSSI	31	3	3	7	8.55316	251.38	8.64	.	7
276	94	NZWAIMAN	19	31	2	13	8.55243	259.28	6.99	0	99
277	125	NATAL	1	18	3	23	8.55241	171.69	8.25	0	12
278	2	OVERON	6	36	2	9	8.55036	257.31	7.01	0	5
279	21	ROSSI	31	23	3	2	8.54992	311.62	6.35	.	7
280	110	NZOAKURA	24	28	1	21	8.54733	278.61	5.71	0	92
281	37	BOMBALA	36	1	1	20	8.54607	233.42	9.20	0	48
282	36	BOMBALA	8	21	3	39	8.54323	212.11	8.33	0	31
283	117	BARRINGT	4	6	2	2	8.54056	212.70	8.67	.	18
284	18	ROSSI	34	8	3	23	8.53824	243.40	7.71	0	50
285	15	ROSSI	28	7	3	36	8.53752	234.22	8.64	0	51
286	23	ROSSI	53	2	2	29	8.53661	268.13	8.05	0	29
287	45	ROBERTSN	26	32	2	32	8.53536	247.46	7.59	0	119
288	126	NATAL	29	33	1	41	8.53505	262.41	8.00	1	25
289	124	NATAL	20	26	2	18	8.53340	211.77	9.53	0	4
290	18	ROSSI	34	16	3	19	8.53029	242.23	7.71	0	50
291	68	TALLAGN	7	32	1	12	8.52636	237.46	7.59	0	45
292	7	OVERON	39	33	1	15	8.52369	313.41	7.00	.	20
293	36	BOMBALA	8	16	3	10	8.52103	235.23	7.71	0	31
294	97	NZROTORU	32	18	1	24	8.52095	250.69	7.23	1	74
295	20	ROSSI	25	27	2	3	8.52067	245.67	7.63	1	10
296	9	OVERON	13	20	3	36	8.52043	208.98	9.68	.	14
297	124	NATAL	20	35	2	5	8.51993	252.60	7.93	0	4
298	20	ROSSI	25	4	2	42	8.51848	262.79	6.97	0	10
299	21	ROSSI	31	19	3	20	8.51814	286.07	7.14	0	7
300	4	OVERON	15	4	1	9	8.51710	330.79	5.97	0	8
301	35	BOMBALA	102	20	2	1	8.51687	267.98	9.68	.	37
302	103	NZOAKURA	2	18	1	30	8.51641	227.69	6.25	1	84
303	94	NZWAIMAN	19	38	2	25	8.51506	282.61	5.71	0	99
304	104	NZOAKURA	3	19	2	41	8.51333	287.07	6.14	1	65
305	124	NATAL	20	29	2	30	8.51202	253.55	7.85	0	4
306	119	BARRINGT	46	14	1	33	8.51199	243.23	9.59	0	24
307	6	OVERON	11	29	3	10	8.51147	237.55	6.95	0	6
308	37	BOMBALA	36	4	1	27	8.51115	260.79	7.97	0	48
309	74	BENDOC	44	14	3	16	8.51072	265.23	8.59	0	40
310	12	ROSSI	49	25	3	6	8.50938	284.21	7.28	0	41
311	19	ROSSI	30	1	1	7	8.50760	306.42	4.20	1	21
312	58	OVERON	21	15	1	20	8.50579	303.91	7.21	1	17
313	14	ROSSI	61	23	2	17	8.50429	250.62	8.35	0	16
314	28	BOMBALA	36	22	1	6	8.50039	273.12	9.13	0	67
315	146	NZCAMBERG	33	7	3	42	8.50024	272.22	7.64	0	36
316	115	BARRINGT	18	1	3	15	8.49851	293.42	6.20	0	15
317	39	ROBERTSN	54	13	3	39	8.49757	267.22	8.41	1	70
318	2	OVERON	6	11	2	9	8.49655	233.54	7.61	0	5

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Plus tree candidates kineth ranked on index
dbh and form adjusted for rep effects

URS	seedlot	origin	family	rank	rep	sets	tree	index	dbh	form	flwr	fruitscore (fam)
319	94	NZMAIHAN	19	21	2	37	8.49577	189.11	9.33	0	0	99
320	18	ROSSI	34	21	3	26	8.49519	247.11	7.93	0	0	50
321	97	NZROTOKU	32	12	1	11	8.49483	282.09	7.05	0	0	74
322	148	NZCAMBERG	45	25	2	4	8.49395	324.21	6.28	3	3	66
323	5	OREKON	4	10	2	8	8.49281	242.79	8.97	0	0	2
324	19	ROSSI	30	5	1	31	8.49192	273.46	5.36	0	0	21
325	116	BAKKINGT	35	30	1	20	8.49155	380.60	7.93	0	0	34
326	104	NZOKUKA	33	3	2	17	8.48949	234.41	8.00	0	0	65
327	18	ROSSI	34	13	3	13	8.48891	191.22	9.41	0	0	50
328	68	TALLAGN	33	7	1	23	8.48800	267.41	7.00	0	0	45
329	60	BOMBALA	63	22	3	13	8.48735	279.12	8.13	0	0	44
330	12	ROSSI	49	13	3	7	8.48721	383.32	3.41	1	1	41
331	36	BOMBALA	29	29	3	23	8.48716	216.35	7.85	0	0	31
332	94	NZMAIHAN	17	4	2	23	8.48609	222.04	8.03	0	0	99
333	126	NATAL	29	4	1	20	8.48464	235.79	7.97	0	0	25
334	128	NATAL	42	12	3	40	8.48311	243.09	9.05	0	0	30
335	13	ROSSI	31	14	1	29	8.48056	266.28	7.99	0	0	53
336	31	BOMBALA	66	23	1	25	8.47937	224.62	9.35	0	0	73
337	110	NZOKUKA	24	18	1	13	8.47881	280.69	5.25	0	0	92
338	148	NZCAMBERG	45	28	2	15	8.47774	257.61	8.71	0	0	66
339	117	BAKKINGT	4	29	2	15	8.47669	198.35	8.85	0	0	18
340	34	BOMBALA	28	14	1	31	8.47582	219.23	9.59	1	1	28
341	148	NZCAMBERG	45	13	2	21	8.47538	265.22	8.41	2	2	66
342	117	BAKKINGT	4	10	2	32	8.47537	229.01	7.69	0	0	16
343	32	BOMBALA	82	4	3	3	8.47440	232.79	7.97	0	0	68
344	15	ROSSI	32	32	3	30	8.47286	272.46	7.59	0	0	51
345	31	BOMBALA	66	20	1	9	8.47022	240.98	8.68	0	0	73
346	97	NZROTOKU	32	35	1	17	8.46963	251.60	6.93	0	0	74
347	4	OREKON	5	15	1	12	8.46834	260.46	8.36	0	0	8
348	111	RENUOC	32	25	2	34	8.46752	311.46	6.59	0	0	56
349	97	NZROTOKU	32	25	1	2	8.46678	321.21	4.28	0	0	74
350	20	ROSSI	25	19	2	20	8.46543	224.07	8.14	0	0	10
351	103	NZOKUKA	28	28	1	4	8.46343	181.61	7.71	0	0	84
352	20	ROSSI	36	2	2	6	8.46411	227.31	8.01	1	1	10
353	104	NZOKUKA	3	29	2	31	8.46317	325.69	6.85	1	1	78
354	138	NZMUNTER	69	30	2	1	8.46348	234.35	7.85	1	1	65
355	17	ROSSI	52	15	2	31	8.46314	329.91	7.21	0	0	61
356	94	NZMAIHAN	19	30	2	2	8.46206	249.69	6.85	0	0	99
357	17	ROSSI	52	14	2	8	8.46151	227.38	8.83	0	0	61
358	10	OREKON	17	14	1	34	8.46119	208.23	9.59	0	0	22
359	36	BOMBALA	8	2	3	15	8.45898	207.12	8.05	0	0	31
360	149	NZCAMBERG	80	22	3	21	8.45407	271.12	10.13	0	0	60
361	126	NATAL	34	29	1	25	8.45316	254.86	7.83	0	0	25
362	18	ROSSI	34	25	3	8	8.45186	189.21	9.28	0	0	59
363	110	NZOKUKA	24	29	1	23	8.45068	313.55	3.85	1	1	92
364	116	BAKKINGT	9	8	1	35	8.45065	280.40	7.71	0	0	34
365	17	ROSSI	52	19	2	34	8.45064	268.07	9.14	.	.	61
366	105	NZOKUKA	55	21	3	16	8.44981	271.11	9.33	0	0	71
367	128	NATAL	42	19	3	22	8.44865	262.07	8.14	0	0	30
368	31	BOMBALA	66	7	1	19	8.44817	265.22	7.64	0	0	73
369	4	OREKON	34	15	1	16	8.44772	297.86	6.83	1	1	8
370	68	TALLAGN	15	15	1	8	8.44721	269.09	7.05	0	0	45
371	68	TALLAGN	7	18	1	5	8.44643	254.69	7.25	0	0	45

Plus tree candidates Kinleith ranked on index
dbh and form adjusted for rep effects

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OBS	seedlot	origin	family rank	rep	sets	tree	index	dbh 11	form 11	flwr 11	frostscore (fan)
372	126	NATAL	29	20	1	11	8.44642	204.90	9.68	0	25
373	97	NZROTORU	32	5	1	27	8.44395	236.46	7.36	0	74
374	18	ROSSI	34	3	3	33	8.44259	257.58	6.64	1	50
375	124	NATAL	20	3	2	16	8.44148	301.58	5.64	0	4
376	9	OBERON	13	7	3	41	8.44107	251.22	7.64	0	14
377	13	ROSSI	14	4	1	23	8.43963	260.79	7.97	0	53
378	125	NATAL	1	21	3	19	8.43854	232.11	5.33	0	12
379	99	NZOAKURA	12	9	3	1	8.43831	197.30	8.64	0	43
380	43	ROBERTSON	67	17	3	12	8.43764	277.04	9.03	0	103
381	15	ROSSI	28	29	3	27	8.43570	286.55	6.85	0	51
382	110	NZOAKURA	24	12	1	12	8.43389	200.09	8.05	0	92
383	15	ROSSI	28	27	3	9	8.43388	265.67	7.63	0	51
384	2	OBERON	6	33	2	21	8.43365	240.41	7.00	0	5
385	7	OBERON	39	7	1	22	8.43340	293.22	7.64	0	20
386	106	NZOAKURA	65	13	1	16	8.43318	283.22	8.41	0	108
387	2	OBERON	6	13	2	17	8.43123	229.22	7.41	0	5
388	148	NZCAMBERG	45	26	2	32	8.43068	307.77	6.55	0	66
389	115	BARRINGT	18	10	3	12	8.43027	314.01	7.69	0	15
390	97	NZROTORU	32	7	1	13	8.42954	306.22	4.64	2	74
391	110	NZOAKURA	24	23	1	11	8.42930	323.62	3.35	0	92
392	9	OBERON	13	23	3	23	8.42858	230.62	8.35	0	14
393	97	NZROTORU	32	28	1	25	8.42627	224.61	7.71	0	74
394	39	ROBERTSON	54	22	3	32	8.42518	211.17	10.13	0	70
395	28	BOMBALA	86	2	1	23	8.42471	264.12	9.05	0	69
396	68	TALLAGH	7	29	1	1	8.42410	235.55	7.85	0	45
397	97	NZROTORU	32	2	1	36	8.42303	268.12	6.05	0	74
398	5	OBERON	10	25	2	26	8.42217	224.21	9.28	0	2
399	23	ROSSI	53	17	2	35	8.42077	278.04	7.03	1	29
400	19	ROSSI	30	4	1	18	8.42018	246.79	5.97	.	21
401	57	NZCHARTER	16	5	1	4	8.41957	240.46	9.36	2	77
402	60	BOMBALA	63	28	3	23	8.41811	253.61	8.71	.	44
403	12	ROSSI	49	24	3	9	8.41785	290.04	6.55	0	41
404	124	NATAL	20	7	2	20	8.41763	245.22	7.64	0	4
405	126	NATAL	29	3	1	27	8.41711	254.58	7.64	0	25
406	4	OBERON	15	20	1	34	8.41668	217.98	9.68	0	8
407	31	BOMBALA	66	8	1	24	8.41437	258.40	7.71	0	73
408	18	ROSSI	34	2	3	21	8.41384	216.12	8.05	0	50
409	152	BADJA	48	2	2	6	8.41103	297.12	7.05	0	38
410	10	OBERON	17	25	1	22	8.41025	288.21	6.28	0	23
411	2	OBERON	6	7	2	36	8.40946	299.22	4.64	0	5
412	32	BOMBALA	82	14	2	22	8.40911	253.23	7.59	1	68
413	115	BARRINGT	18	13	3	23	8.40858	243.22	7.41	0	15
414	80	BAUJA	56	5	1	38	8.40806	247.46	9.36	0	76
415	13	ROSSI	14	35	1	34	8.40785	283.60	6.93	0	53
416	109	NZMANGAN	41	29	1	6	8.40666	263.61	6.71	0	121
417	73	BENDOC	58	18	3	41	8.40594	319.69	7.25	0	19
418	31	BOMBALA	66	4	1	37	8.40544	223.79	8.97	0	73
419	30	BOMBALA	90	24	3	10	8.40512	238.04	8.55	0	13
420	146	NZCAMBERG	33	29	3	32	8.40422	252.55	7.85	0	86
421	20	ROSSI	25	31	2	21	8.40401	293.28	4.99	0	10
422	31	BOMBALA	66	13	1	34	8.40293	238.22	8.41	0	73
423	5	OBERON	10	7	2	32	8.40243	230.22	8.64	0	2
424	111	BENDOC	75	8	2	4	8.40070	298.40	6.71	0	56

Plus tree candidates Kinleith ranked on index
dbh and form adjusted for rep effects

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OBS	seedlot	origin	family rank	rep	sets	tree	index	dbh 11	form 11	flur 11	frostscore (fam)
425	115	BARRINGT	18	9	3	30	8.39996	267.30	6.64	0	15
426	128	NATAL	42	18	3	38	8.39783	251.69	8.25	0	30
427	2	OVERON	6	17	2	8	8.39572	234.04	7.03	1	5
428	50	NZKAINGR	122	35	1	2	8.39379	369.60	7.93	0	80
429	117	BARRINGT	4	9	2	3	8.39355	218.30	7.64	0	18
430	98	NZOAKURA	22	35	2	34	8.39302	260.60	6.93	1	90
431	122	BARRINGT	38	4	1	4	8.39187	287.79	7.97	0	23
432	128	NATAL	42	29	3	40	8.39010	287.55	6.85	0	30
433	36	BOMBALA	8	8	3	10	8.39008	232.40	6.71	0	31
434	117	BARRINGT	4	20	2	21	8.38987	295.96	4.68	.	18
435	97	NZROTORU	32	26	1	25	8.38890	249.77	6.55	0	74
436	122	BARRINGT	38	21	1	32	8.38684	251.11	9.33	0	23
437	37	BOMBALA	36	25	1	18	8.38611	234.21	8.28	0	48
438	68	TALLAGN	7	4	1	2	8.38319	252.79	6.97	0	45
439	12	ROSSI	49	28	3	39	8.38247	280.51	6.71	.	41
440	117	BARRINGT	4	32	2	17	8.37886	217.46	7.59	0	18
441	110	NZOAKURA	24	36	1	26	8.37870	272.31	5.01	0	92
442	124	NATAL	20	5	2	4	8.37865	220.46	8.36	0	4
443	6	OVERON	11	14	3	24	8.37807	251.23	5.59	0	6
444	150	NZCAMBERG	89	3	1	6	8.37623	303.59	7.64	0	57
445	113	ROBERTSON	109	21	1	2	8.37592	277.11	9.33	0	113
446	37	BOMBALA	36	15	1	18	8.37540	260.91	7.21	2	48
447	60	BOMBALA	63	29	3	21	8.37486	243.55	8.85	0	44
448	98	NZOAKURA	22	23	2	14	8.37343	246.62	7.35	0	90
449	19	ROSSI	30	6	1	42	8.37246	247.70	5.67	0	21
450	10	OVERON	17	3	1	30	8.36866	272.58	6.64	0	22
451	111	BENDOC	75	13	2	30	8.36745	222.32	9.41	1	56
452	122	BARRINGT	38	6	1	28	8.36745	265.70	6.67	0	23
453	60	BOMBALA	63	23	3	11	8.36709	235.62	8.35	.	44
454	64	YELTHOLM	37	8	3	8	8.36670	279.40	7.71	0	26
455	10	OVERON	17	35	1	18	8.36650	264.60	6.93	0	22
456	94	NZUAINAN	19	34	2	17	8.36442	235.86	6.83	0	99
457	152	BADJA	48	31	2	18	8.36344	265.38	7.99	2	38
458	88	NZROTORU	104	31	3	29	8.36255	310.28	7.99	0	98
459	17	ROSSI	52	5	2	14	8.36073	275.46	8.36	0	61
460	2	OVERON	6	3	2	25	8.36041	265.58	5.64	.	5
461	19	ROSSI	30	31	1	7	8.35811	184.28	7.99	0	21
462	124	NATAL	20	19	2	25	8.35686	223.07	9.14	1	4
463	119	BARRINGT	46	23	1	10	8.35591	226.62	9.35	0	24
464	64	YELTHOLM	37	25	3	14	8.35234	262.21	6.28	0	26
465	5	OVERON	10	35	2	17	8.35223	249.60	7.93	1	2
466	64	YELTHOLM	37	16	3	22	8.34905	303.23	6.71	0	26
467	115	BARRINGT	18	14	3	38	8.34870	308.23	8.59	0	15
468	8	OVERON	5	16	2	9	8.34783	247.23	5.71	0	9
469	115	BARRINGT	18	2	3	20	8.34611	232.12	8.05	0	15
470	119	BARRINGT	46	11	1	12	8.34579	297.54	6.61	0	24
471	74	BENDOC	44	3	3	6	8.34529	339.58	8.64	3	40
472	105	NZOAKURA	55	1	3	35	8.34405	289.42	6.20	2	71
473	124	NATAL	20	25	2	37	8.34217	217.21	8.28	0	4
474	35	BOMBALA	102	2	2	39	8.34051	295.12	8.05	0	37
475	21	ROSSI	31	29	3	36	8.34009	267.55	6.85	0	7
476	32	BOMBALA	82	25	2	6	8.33966	251.21	7.23	2	68
477	104	NZOAKURA	3	35	2	29	8.33930	240.60	6.93	0	65