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Assessment and analysis of a *Pinus kesiya* provenance trial at Grootgeluk, South Africa

Trial no. 4 in the *Pinus kesiya* series

by

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Natural *Pinus kesiya* stand in the Central Highlands of Vietnam around Dalat. Photo: Christian Pilegaard Hansen

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Danida Forest Seed Centre (DFSC) is a Danish non-profit institute which has been working with development and transfer of know-how in management of tree genetic resources since 1969. The development objective of DFSC is to contribute to improve the benefits of growing trees for the well-being of people in developing countries. DFSC's programme is financed by the Danish International Development Assistance (Danida).

Preface

This report presents the results of a joint assessment of the *Pinus kesiya* provenance trial established at Grootgeluk, South Africa. The trial was established by Sappi Forest Research, South Africa in February 1991 as part of an international series of provenance trials of the species.

The joint Sappi/DFSC field assessment took place in August 1998 by a team consisting of Milton (Usutu, Swaziland), Frans Mbokane, Valley Mabasa and George Nolela of Sappi and Dorthe Joeker of DFSC.

Terry Stanger of Sappi Forest Research is thanked for his kind assistance in planning and practical arrangements for the field assessment.

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Contents

Preface i
Contents iii
Acronyms and abbreviations iv

1. Background 1

2. P. kesiya provenance trials in South Africa 2
2.1 Earlier trials 2
2.2 Present trial – B65 at Grootgeluk 2

3. Field assessment and data management 4

4. Statistical analysis 5
4.1 Plot of raw data 6
4.2 Statistical model 6
4.3 Co-variates 6
4.4 Check of model assumptions 7
4.5 What to do when model assumptions are not fulfilled? 8
4.6 Fixed or random effects 9
4.7 Test of differences between provenances 9
4.8 Lsmeans (estimates from the fixed model) 9
4.9 Best Linear Unbiased Predictors (BLUPs - estimates from the random model) 10

5. Results of statistical analysis of individual traits 11
5.1 Survival 12
5.2 Height growth 14
5.3 Diameter growth 16
5.4 Mean volume of tree 18
5.5 Total volume per hectare 20
5.6 Stemform 22
5.7 Wood density 24
5.8 Foxtailing 26
5.9 Cone setting 28
5.10 Branch diameter 30

6. Discussion and Conclusions 32
6.1 Growth 32
6.2 Adaptation 32
6.3 Quality 32
6.4 Conclusion 33

7. References 34

Annexes

Annex 1 Trial design map
Annex 2 Trial description
Annex 3 Site description
Annex 4 Plot data set

Acronyms and abbreviations

BSO	Breeding seed orchard
CAMCORE	Central America and Mexico Coniferous Resources Co-operative, USA
CIEF	Centro de Investigaciones y Experiencias Forestales, Argentina
CSIRO	Commonwealth Scientific and Industrial Research Organisation, Australia
CSO	Clonal seed orchard
Danida	Danish International Development Assistance
DFSC	Danida Forest Seed Centre, Humlebæk, Denmark
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária, Petrolona, Pernambuca, Brazil
FAO	Food and Agriculture Organization of the United Nations, Rome, Italy
FRC	Forest Research Centre, Forestry Commision, Harare, Zimbabwe
ICFRE	Indian Council of Forestry Research and Education, Dehra Dun, India
IF	Instituto Florestal, São Paulo, Brazil
IPEF	Instituto de Pesquiasa e Estudos Florestais, Piracicaba, Brazil
OFI	Oxford Forestry Institute, United Kingdom
RCFTI	Research Centre for Forest Tree Improvement, Forest Science Institute, Vietnam
RFD	Royal Forest Department, Thailand

1. Background

The Grootgeluk trial forms part of an international series of provenance trials of *P. kesiya*.

The objective of the international series is to explore and analyse the genetic variation in growth, quality and adaptive traits among provenances of *P. kesiya* throughout the range of the species. The results will facilitate an informed choice of seed source in planting programmes. Furthermore, the results will be useful when planning conservation activities of the species.

Below the background of the international series is briefly described.

Initial research on inter-population differences in *P. kesiya* was undertaken in Zambia in the 1950s. The test material included provenances from the Philippines, Vietnam and Assam. A comprehensive review of these studies is provided by Armitage and Burley (1980).

During 1969, FAO and the Forest Research Institute of Australia sponsored seed collections of 19 seed sources of *P. kesiya* from the Philippines (17 provenance collections and 2 commercial seedlots). The material was complemented by two Zambian land races (of Philippine and Vietnamese origin, respectively). These collections were used for provenance trials in a large number of countries for which the Commonwealth Forestry Institute supplied advice and assisted in data processing and interpretation (Burley and Wood 1976). Results from individual trials were reviewed by Gibson and Barnes (1984). They concluded that neither provenance representation nor test site representation warranted an international evaluation. It was recommended that a more comprehensive exploration and analysis of the genetic variation of *P. kesiya* should be undertaken. Recommendations in this regard was also put forward by the Sixth Session of the FAO Panel of Experts on Forest Gene Resources (FAO 1988).

Exploration of provenance variation and collection of seed for field trials took place in the late 1980s in collaboration between national institutions in Brazil, Myanmar, China, Madagascar, Philippines, Thailand, Vietnam, Zambia, Zimbabwe, Oxford Forestry Institute (OFI) and Danida Forest Seed Centre (DFSC). In 1988, seed collections were complete and distribution to collaborating countries could begin (Barnes et al. 1989). Distribution of seed was co-ordinated by OFI and handled by DFSC. During 1989-93, seed of 42 provenances and land races from the above 9 countries were distributed to 20 institutions in 19 countries. Some seedlots were separated by family to allow testing of individual progenies.

A status on seed distribution and established field trials is found in DFSC (1996) and DFSC (1997). Some 30 trials have been established in 17 countries. Trials in Argentina, Brazil, Colombia, Indonesia, South Africa, Swaziland, Vietnam and Zimbabwe are reported with high survival and are in general in good conditions. Status of trials in Burundi, India, Rwanda and Sri Lanka is unknown, as no information has been received from these countries. Trials established in Fiji, Kenya, Nepal, the Philippines and Thailand have been abandoned because of fire damage, drought and browsing.

In a circular letter sent out by OFI and DFSC in 1996, host institutes were asked about their interest in undertaking a joint evaluation and were at the same time asked about the status of the trials (DFSC 1996). Positive responses in regard to the proposal of undertaking a joint assessment and analysis of trials have been received from all countries where existence of trials has been confirmed. The number, distribution and representation of provenances in these trials were considered sufficient to justify an assessment and analysis of the international series. Of special interest is the possibility of an in-depth analysis of provenance x site interactions, thanks to the representation of the same set of provenances at many trial sites.

A manual was elaborated during 1997-98 with a proposal for a set of characters to be assessed in all trials (DFSC 1998). Field assessment of trials commenced in April 1998 in Vietnam.

2. *P. kesiya* provenance trials in South Africa

2.1 Earlier trials

P. kesiya was first introduced to South Africa in 1906 from Assam and later in 1915 from the Philippines (Poynton 1979). The species had a good growth potential but stemform was poor compared to most other pines. Early tests showed that the Philippine sources had far better growth and quality than the Assam one.

In 1972-3, 5 provenance trials were established in South Africa as part of the first international series of trials organised by FAO and the Australian Forest Research Institute (cf. Chapter 1). 23 entries were tested; 17 seedlots from the Philippines, two seedlots from Zambia (one of Vietnamese, one of Philippine origin), two offsprings from seed orchards in South Africa and *P. caribaea* and a *P. elliottii* controls. Three of the trials have been assessed and analysed, and results are described in Darrow (1984). The South African seed orchard offsprings and the Zambia sources are in general of higher production and of better quality than the seedlots originating from the natural range (Darrow 1984).

2.2 Present trial – B65 at Grootgeluk

The Forest Research Division of Sappi has established two trials of *P. kesiya* in connection with the international series of trials co-ordinated by DFSC and OFI. The trials were established at Grootgeluk and Melmoth. The Melmoth trial has later been affected by fire, and only the Grootgeluk trial has been assessed as part of the present work.

The Grootgeluk trial is described in Annex 2 and Annex 3.

There are 6 replications and 90 seedlots being tested, as shown in the below table.

In the present assessment, only the 'full' provenances have been assessed, not the single tree progenies. This leaves 36 seedlots for assessment.

The seedlots 1623-1634 are *P. yunnanensis*, the rest is *P. kesiya* (except for the controls).

The Zimbabwe CSO seedlot (1776/88) originates from a single clone according to available information. Seed from all the ramets of this clone in the orchard has been bulked and thus represent half-sibs where the male percentage is (theoretically) a mixture of all the other clones in the seed orchard. The results for this seedlot should be interpreted with caution, as the seedlot does not provide a fair representation of the seed orchard as such.

Furthermore, there is some uncertainty about the number of mother trees in the seedlots 1766 (Wat Chan of Thailand), 1638 (Lancang, China) and 1639 (Simao, China). Results of these seedlots therefore also need to be interpreted with care.

More information on seedlots in DFSC (1998).

Family No.	Acc. No.	Name
1	1447/84	Mt. Province, Phillipines
3	1506/85	Tarlac, Philippines
4	1515/8500	Dathien, Vietnam
5	1516/8500	Xuan Tho, Vietnam
6	1517/8500	Hothien, Vietnam
7	1518/8500	Thac Prenn, Vietnam
9	1519/8515	Single tree progeny
10	1519/8534	Single tree progeny
11	1519/8537	Single tree progeny
12	1519/8538	Single tree progeny
13	1519/8548	Single tree progeny
14	1519/8549	Single tree progeny
15	1519/8556	Single tree progeny
16	1519/8557	Single tree progeny
19	1521/8500	Nong Krating, Thailand
20	1522/8500	Doi Suthep, Thailand
21	1522/8502	Single tree progeny
22	1522/8503	Single tree progeny
25	1522/8507	Single tree progeny
29	1522/8520	Single tree progeny
30	1522/8521	Single tree progeny
32	1524/8500	Phu Kradung, Thailand
33	1525/8500	Nam Now, Thailand
35	1525/8503	Single tree progeny
38	1525/8508	Single tree progeny
39	1525/8510	Single tree progeny
40	1525/8511	Single tree progeny
41	1525/8512	Single tree progeny
42	1525/8513	Single tree progeny
72	1766/88-	Wat Chan, Thailand
44	1554/8501	Single tree progeny
45	1554/8502	Single tree progeny
48	1554/8505	Single tree progeny
49	1554/8506	Single tree progeny
50	1554/8507	Single tree progeny
51	1554/8508	Single tree progeny
52	1554/8509	Single tree progeny
53	1554/8510	Single tree progeny
71	1680/86	Dakha, Vietnam
54	1623/86	Shangbai, China
56	1625/86	Baoshan (2), China
57	1626/86	Maguan, China
59	1628/86	Huize, China

Family No.	Acc. No.	Name
60	1629/86	Lan Ping, China
64	1633/86	Shangsi, China
65	1634/86	Dukou, China
66	1635/86	Jingdung (1), China
69	1637/86	Jinhong, China
69	1638/86--1	Lancang, China
70	1639/86--3	Simao, China
110	1781/88	Jingdung (3), China
73	1772/8800	Zokhua, Burma
74	1772/8801	Single tree progeny
78	1772/8805	Single tree progeny
79	1772/8808	Single tree progeny
81	1772/8810	Single tree progeny
83	1772/8812	Single tree progeny
84	1773/8800	Aungban, Burma
85	1773/8801	Single tree progeny
86	1773/8802	Single tree progeny
88	1773/8805	Single tree progeny
90	1773/8807	Single tree progeny
91	1773/8808	Single tree progeny
92	1773/8809	Single tree progeny
93	1773/8810	Single tree progeny
94	1773/8811	Single tree progeny
97	1776/88	John Meikle CSO, Zimbabwe

Family No.	Acc. No.	Name
99	1778/8800	CSO, Zambia
100	1778/8801	Single tree progeny
104	1778/8805	Single tree progeny
105	1778/8806	Single tree progeny
106	1778/8807	Single tree progeny
111	1782/8801	Single tree progeny
112	1782/8802	Single tree progeny
115	1782/8805	Single tree progeny
116	1782/8806	Single tree progeny
118	1782/8808	Single tree progeny
119	1782/8809	Single tree progeny
120	1782/8810	Single tree progeny
121	1783/88	Bodana A8, Madagascar
122	1786/8800	Morarano, Madagascar
125	1786/8803	Single tree progeny
130	1786/8809	Single tree progeny
132	1786/8815	Single tree progeny
133	15133	Control
134	23184	Control (*P. kesiya*)
135	5/87	Control
136	m2012	Control (*P. patula*)
137	9	Control (*P. elliottii*)
138	23493	Control (*P. elliottii*)

3. Field assessment and data management

The assessment followed the methodology described in DFSC (1998). It involved the characters:

1. Survival;
2. Health;
3. Social status (Kraft);
4. Height;
5. Diameter (DBH);
6. Straightness;
7. No. of whorls;
8. No. of branches in whorl;
9. Branch diameter;
10. Crown length;
11. No. of forks;
12. Position of first fork;
13. Foxtail;
14. Flowering and fruiting;
15. Wood density (Pilodyn);

For a detailed description of the assessment methodology, please refer to DFSC (1998).

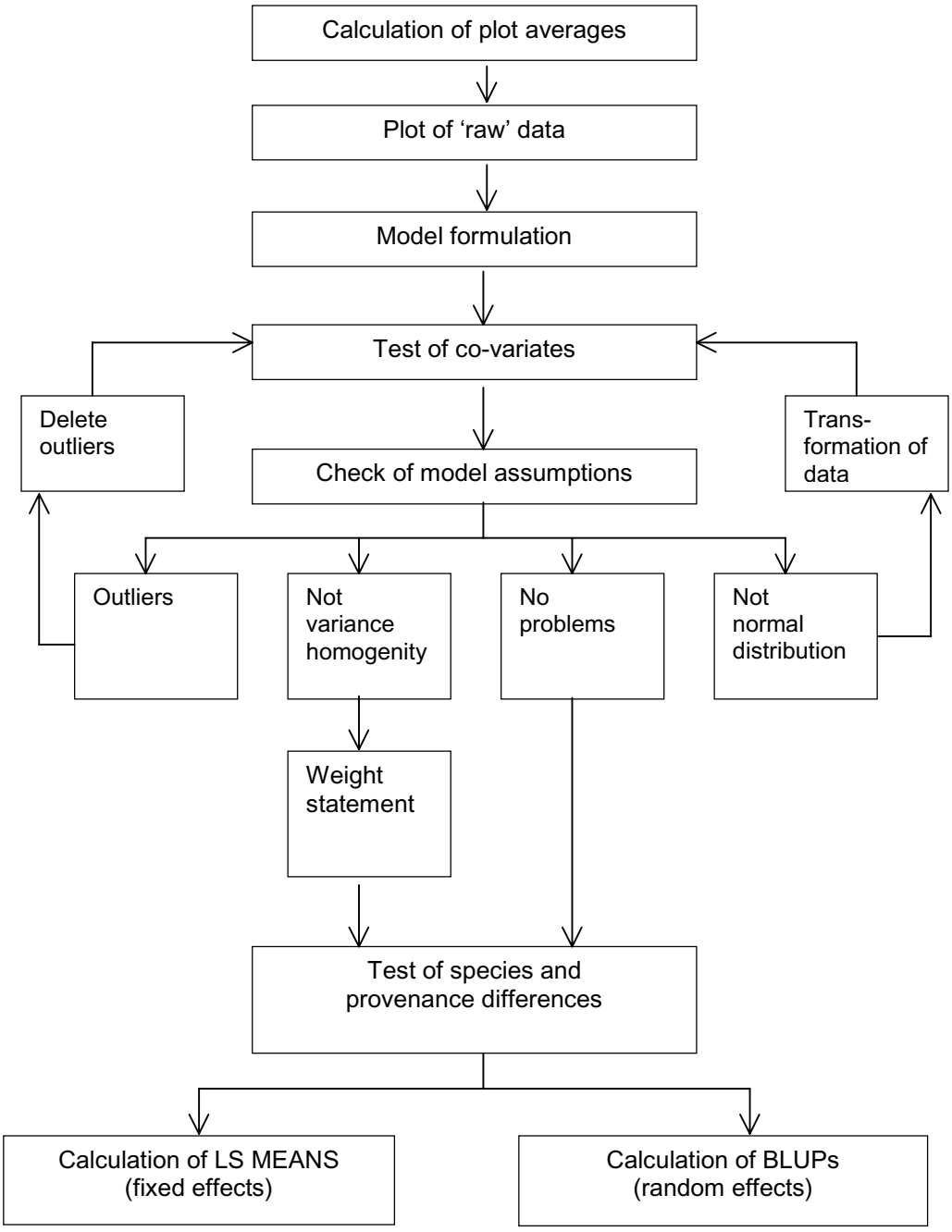
The assessment was a full assessment, i.e. all trees in all plots were included.

Relative wood density was measured with a Pilodyn wood tester with pin diameter 2.0 mm.

Assessment data was recorded in the field on assessment sheets, see example in DFSC (1998). The data was immediately after the assessment entered to a lap-top computer in spreadsheet format. From the shread-sheet, data was later imported to a SAS-dataset for further analysis.

4. Statistical analysis

Overview of steps involved in the statistical analysis



The objectives of the statistical analysis are:

- to examine statistically significant differences between seedlots (provenances) in adaptability, growth and quality traits. A list of analysed traits is provided in Chapter 5;
- to conclude and recommend on the practical application of the results (species and provenance recommendations);
- to investigate patterns of genetic variation;
- to provide data for an overall analysis of the international series of provenance trials of *Pinus kesiya*, i.e. analysis across sites. This step will await completion of the analysis of individual trials.

Statistical analysis is done on plot values, e.g. plot averages or plot sums. Calculation of plot values is described in Annex 4.

The SAS analytical package has been used for the analysis (SAS, 1990).

The statistical analysis of each trait follows a sequence of steps. They are:

1. Plot of raw data;
2. Formulation of statistical model;
3. Test of co-variates;
4. Check of model assumptions;
5. When model assumptions are not fulfilled: (a) transformation of data; (b) deletion of outliers; (c) weight statement;
6. Test of differences between species and provenances;
7. Calculation of lsmeans (estimated from a model with fixed effects);
8. Calculation of BLUPs (estimated from a model with random effects).

The statistical analysis is illustrated in the above figure and the steps are further described in the below text.

Generally speaking, two different approaches are applied in the statistical analysis: a fixed effect approach and a random effect approach. The fixed effects approach is concerned with the genetic entries (seedlots) actually in the trial, whereas the random effects approach concerns what would happen if the experiment was to be repeated. Following the fixed effect approach, the estimates are calculated as least square means (lsmeans), whereas the random effect approach gives the best linear unbiased predictors (BLUPs). See further explanation below.

4.1 Plot of raw data

The main purpose of the plots is to indicate the scale of the variable along with a first impression of the variation within the trial. Often the visual inspection of the data reveals clear differences between the provenances, or gives hints regarding proper transformations of the data. Obvious outliers (extreme values) may also be identified already at this stage.

The most useful single plot is probably a plot of the variable against the provenances, marking the values with values identifying the blocks. However, other plots may also be relevant, e.g. plotting the values by block or by the distance along the axis of the trial.

4.2 Statistical model

The test of differences between seedlots (provenances) is based on the model:

$$X_{jk} = \mu + provenance_j + block_k + \varepsilon_{jk}$$

where X_{jk} is the value of the trait in question (e.g. height) in plot *jk*,
μ is the grand mean,
$provenance_j$ is the effect of seedlot number *j* and is assumed to be either a fixed or a random effect, according to which approach is used (see later),
$block_k$ is the effect of block *k* in the trial, assumed to be a random effect, and
ε_{jk} is the residual of plot *jk* and is assumed to follow a normal distribution $N(0, \sigma_e^2)$.

Please note that the controls (seedlots not *Pinus kesiya*/*P.yunnanensis*) are considered (analysed) together with these sources not considering that they actually are sources of different species.

4.3 Co-variates

In order to reduce the residual variation in trials with heterogeneous trial conditions (e.g. variation in soil, elevation, slope and exposure within trial), a number of co-variates are included in the model. As a standard routine the following four co-variates are tested:

plotx: Horizontal position of plot within trial (see map of trial);
ploty: Vertical position of plot within trial (see map of trial);

To catch non-linear patterns of site variation vertically and horizontally, plotx2 and ploty2 are applied:

plotx2: $plotx2 = (plotx - mean(plotx))^2$
ploty2: $ploty2 = (ploty - mean(ploty))^2$

In addition to the above four co-variates, additional co-variates are considered in some of the trials:

level: Level of plot in relation to a reference plot within the trial (0);
plotxy $Plotxy = plotx \times ploty$

In testing the effect of co-variates, we start with a model with all co-variates included. Co-variates that are not significant are removed successively by removing the least significant co-variate and

running the model again until all remaining co-variates in the model are significant ($P<0.10$).

4.4 Check of model assumptions

The statistical model rests on a number of standard assumptions. Key assumptions are (see e.g. Box et al. 1978):

(i) that the residuals are independent;
(ii) that the residuals follow a normal distribution;
(iii) that there is variance homogeneity in effects included in the model.

The model assumptions are checked graphically by producing a number of plots:

1. Student's residuals versus predicted values;
2. Cooks distance versus predicted values;
3. Student's residuals versus provenance;
4. Frequency chart of residuals;
5. Student's residuals versus block;
6. Student's residuals versus plotx;
7. Student's residuals versus ploty;
8. Student's residuals versus level (if level is among the considered co-variates).

The residuals represent variation that can not be accounted for by the model. For each observation, the model calculates a predicted value, taking into account the effects of the model (provenance, block and co-variates). The residual variation is then the difference between the observed value and the predicted value.

Student's residuals (also called 'standardised residuals') are calculated as the residual divided by its standard error. If the assumption of normal distributed residuals is valid, the Student's residuals have the property of a normal distribution with mean 0 and variance 1, meaning that 95% of the values should lie within ± 1.96. In cases of trials with imbalance, the Student's residuals correct for imprecision due to low sample numbers, and in models with co-variates they compensate for large deviations at extreme values.

The Student's residual e_t for observation *ij* is given by

$$e_t = \frac{e_{ij}}{s_{ij}} = \frac{X_{ij} - P_{i\bullet} - B_{\bullet j}}{s_{ij}}$$

where e_{ij} is the residual, X_{ij} is the value for observation *ij*, $P_{i\bullet}$ is the effect of provenance *i*, $B_{\bullet j}$ is the effect of block *j*, and s_{ij} is the standard deviation (standard error) of observation *ij*.

Cooks distance gives a measure of the influence of a single observation (plot) on the model, and gives an indication of possible 'outliers' (see below) (Afifi & Clark 1996). A high value indicates an observation with a large influence on the outcome of the model.

In the following, a description of the check of the model assumptions is given.

Independence

The assumption of independence means that the residual of one observation is not dependent on the residual of another. This assumption is typically violated when using pseudo-replicates, e.g. when doing more observations on the same experimental unit and treating them as different experimental units. Another example is when two or more plots of the same provenance within the same block are treated as independent observations. In such cases, an average of the values should be used as the block value for the provenance in question.

The graphical check of the residuals does not reveal possible problems with observations dependent upon each other, and there is no easy method to ensure that the condition of independence is fulfilled. Proper design and planning of the experiment result and application of a correct statistical model is the best insurance to obtain independent observations.

The assumption of independence may also be violated if there is a time- or site-dependency in the data. To check for such dependency, residuals are plotted against the horizontal and vertical axis of the trial (plotx and ploty) and where applicable, also the level of plot, to investigate any systematic environmental variation. Usually there is none, as the co-variates (plotx and ploty) account for this.

Normality

The assumption of normality may be checked in various ways, graphically as well as by statistical tests. In this analysis, we use the frequency chart of residuals as a graphical check. In the frequency chart, the frequencies should be more or less bell-shaped with no large tails at the ends. A formal statistical test, the Shapiro-Wilk statistic, is given in the SAS-procedure UNIVARIATE with the option NORMAL (SAS 1988a). This procedure also offers different kinds of plots of the residuals. However, since the test is usually considered to be conservative, rejecting only severe deviations from normality, the test results should be considered with caution (Brockhoff, pers. comm.).

When the number of observations is low, it becomes increasingly difficult to check the assumption of normality. Even though the frequency chart may show a rather odd and irregular distribution, this need not be a sign of non-normality. At small sample sizes it is not unlikely that odd distributions may result from random variation, and unless the test for normality demonstrates that the assumption is violated, there is no need to reject the model. On the other hand, when the number of samples is very large, the test for normality may become rejected even though the frequency chart of residuals appears to be normal. This is because the power of the test increases with the number of observations, and even small deviations from normality may result in rejection of the hypothesis of normal distributed residuals. In such cases it should be considered whether the frequency chart indicate that the

assumption is fulfilled, or the deviations are so large that transformation of data (see later) is required.

Deviations from the assumption of normality may also be interpreted as a distribution with a large number of outliers (see later).

Variance inhomogeneity

Variance inhomogeneity occurs when different experimental units (blocks and provenances) have different variance. A typical example is when the residuals of some provenances appear very clustered in the diagram of Student's residuals versus provenances, whereas the residuals of other provenances are spread out, often with values of Student's residuals exceeding ±2. This may result from a simple scale effect (larger provenances have larger variance), in which case the plots of Student's residuals and Cook's distance versus predicted values appear funnel-shaped. It may also be related to the provenance itself (some provenances are more variable than others). In this case, the variance inhomogeneity will be displayed in the plot of student's residuals versus provenance.

Outliers

Outliers are extreme observations that do not follow the trends of the remaining data. Such observations may have a large influence on the estimates and statistical tests of the model and should therefore be considered carefully.

Outliers are detected by inspection of the plots of Student's residuals and of Cook's distance. Observations that have values of Student's residuals exceeding ±2.5 (rule of thumb), and observations with large values of Cook's distance, are possible outliers and should be investigated further. Outliers may be due to errors in the recording or typing of data, or due to mislabelling of the seedlots in the nursery or in the field. Poor survival in the plot, leaving only a few trees to use in the calculation of plot means is another source of outliers. However, it also happens that the outliers are due to some unexplained variation, perhaps in soil conditions or other environmental variation. Finally it should be mentioned that a large number of outliers might indicate that the distribution of residuals is not normal, and hence that a transformation of data is required (see later).

When outliers occur as a result of errors, the dataset should of course be corrected, which will solve the problem. It is less obvious what to do in the cases where there are no easy explanations. Outliers should only be excluded if it can be justified, i.e. an explanation can be given. In a few cases, however, explanations were not found, and observations were excluded alone on basis of the extreme nature of the value. Great care is required in the decision to exclude plot values, as it will have great importance for the result of the analysis, especially with few blocks (replications). Running the analysis again without the outlier(s) gives an indication of the sensitivity of the analysis in regard to the outliers, and assist in deciding whether to keep or delete the extreme observation(s).

In the interpretation of the statistical analysis in this report, it is always mentioned if one or more extreme values have been considered as outliers and omitted from the analysis, and on what grounds.

4.5 What to do when model assumptions are not fulfilled?

In many cases one or more of the model assumptions are not fulfilled. In the below, procedures for correction are described.

Independence

Apart from making sure that the statistical design and the model is correct there is not much to do about dependence between observations. If some clear variation can be observed in the residuals, other co-variates than the ones mentioned above could be considered.

Deviations from normality

Usually deviations from normality are handled by transformation of data. Snedecor & Cochran (1980) and Afifi & Clark (1996) provide guidance on data transformations:

1. Counts (of rare events) often follow a Poisson distribution and are transformed with the square root.
2. Variables having a binomial character (e.g. dead or alive) summarised in a proportion (e.g. living trees in a plot) may be transformed with the arc sine transformation.
3. If the standard deviation varies directly with the mean, a logarithmic transformation may stabilise the variance.

There are theoretical reasons for choosing the above transformations (Snedecor & Cochran 1980), but it follows from Afifi & Clark (1996) that the range of transformations may be seen as a continuum and that various other transformations are available.

None of the variables included in the present assessment have the character of a Poisson distribution, but the square root transformation has nevertheless in some cases been applied.

In many cases the analysis of survival data results in skewed distributions of the residuals, with tails at either the lower or upper end (many trees dead or many trees alive). In such cases an arc sine transformation of data will often prove useful. The arc sine transformation is given by

$$\arcsin(proportion) = \sin^{-1}\sqrt{proportion}$$

where proportion is a figure between zero and one (e.g. the surviving fraction of trees). An important property of the transformation is that the variance near zero or one is stretched out, thus facilitating the analysis of variance (Snedecor & Cochran 1980).

For many growth variables, the variance increases directly with tree size, and the proper transformation is thus the logarithm. In most cases, the natural logarithm (ln) has been applied to achieve a normal distribution of residuals.

Variance inhomogeneity
In the cases where the variance varies with the size of the variable, a transformation of data is the proper way to solve the problem (see above). However, in some cases the provenances simply have different variances irrespective of size, and it is necessary to weight the observations with weights proportional to the reciprocals of the error variances to ensure variance homogeneity (SAS 1988b, cf. Afifi & Clark 1996). There may also be cases where different blocks have different variances, but this has not been observed in the present trial(s).

Weighting occurs in the following sequence: An ordinary analysis of variance of the variable is performed. The residuals from this analysis are grouped according to provenance, and the variance of the residuals for each provenance is calculated. The inverse of these variances is then used as weights in an analysis of variance. When calculating the sums of squares in the model, the weights are multiplied with the squared value of the deviance of each observation from the predicted value (SAS 1988b). This has the effect that provenances with small variances have a larger influence on the model than provenances with larger variances. In other words, the more stable the provenance, the more it counts in the analysis. Provenances with large uncertainty on the other hand have less influence.

4.6 Fixed or random effects

A special problem relates to the choice between considering the effects in the statistical model as fixed or random. Statistically speaking, fixed effects are considered as *parameters* (unknown constants). Random effects are considered *stochastic variables* with an expected value of zero and a variance (Skovgård 1994). Fixed effects are used when the individual groups (seedlots) are of interest. Models with random effects are used when interest is in the size of the variation between the groups (described by the variance), including groups that are not represented in the trial. In analysis of random effects it is important that the groups are representative of a larger population of groups, and they should preferably be chosen by randomisation (Skovgård 1994). In the words of Stonecypher (1992), 'fixed models address estimating and testing to infer the existence of true differences among means, whereas the random models address estimating and testing to infer the existence of components of variance'.

To choose between a fixed or a random effects model is a choice with no simple answer. Stonecypher (1992) has formulated the following two questions to facilitate a choice:

1. Are the conclusion confined to the things actually studied; to the immediate sources of these things; or extended to apply to more general population?

2. In complete repetitions of the experiment would the same things be studied again; would new samples be drawn from the same sources; or would new samples be drawn from the general population?

When the objective is to estimate components of variance, the effects should be considered as random. If the objective is to estimate differences among means, the effects should be considered as fixed. In some cases fixed and random effects may be combined in the model (mixed models). This is the case when special designs are applied, such as split-plot or nested designs.

In our model with only provenances and blocks, it is necessary to choose between considering the provenance effect as random or as fixed. If the aim is to compare the specific provenances and the actual production on the site, it is natural to consider the provenance effect as fixed. If, on the other hand, (i) the provenances are assumed to be representatives of a population of provenances; (ii) the aim is to expand the conclusions to this population; (iii) to estimate the production and (iv) should the experiment be repeated, then the provenance effect should be considered as random.

The results of the statistical tests are irrespective of whether the provenance effect is considered a fixed or a random effect. However, there are major differences in the estimates resulting from the two approaches (see below). Since it may be argued that both the fixed and the random approaches are relevant in this analysis, both sets of estimates have been calculated.

4.7 Test of differences between provenances

In our statistical model, differences between provenances for a given trait are tested by an F-test comparing the mean square of provenances with the residual mean square. The hypothesis tested is that there is no difference between the provenances. If the F-test is significant, we reject the hypothesis and conclude that there are significant differences between the provenances.

The testing is done using the GLM procedure in SAS (SAS 1990). Since the testing of random variables may involve combinations of different mean squares (Skovgård 1994), an approximation called Satterthwaites approximation is used in the calculation of degrees of freedom (SAS 1988).

4.8 Lsmeans (estimates from the fixed model)

In the fixed model approach, the estimates for the provenances are calculated as the least square means (lsmeans). The main difference between raw means and lsmeans is that lsmeans account

for missing values and imbalanced designs. Thus, in completely balanced designs there are no differences between lsmeans and the raw means. It follows that the lsmeans are the best estimates for the given provenance in the trial.

The confidence intervals and limits are calculated from the formula (Skovgård 1994)

$$X \pm t_{1-\alpha/2,(a-1)(b-1)} \sqrt{s^2 / b}$$

where X is the least square mean, α is the confidence level (in this case 0.05, giving a 95% confidence interval), a is the number of provenances and b is the number of replicates (blocks) of each provenance. s^2 is the mean square of the error (MS_e). The confidence limits are calculated directly by SAS in the LSMEANS statement with the CL option.

Since the estimates are calculated individually, different provenances may have different lengths of the confidence intervals (due to different variances). In the cases where the data have been weighted, the confidence intervals are adjusted according to the variance of each provenance and thus are of different lengths.

Special problems arise when the data has been transformed. If the least square means and the confidence limits are calculated on basis of the transformed values, the back-transformed estimates will be geometric means rather than arithmetic means. This implies that the estimates become biased towards lower values, and compared to the real values actually are under-estimates. If on the other hand the estimates are calculated using raw data, the lsmeans will be arithmetic means (comparable to the real mean values), but the confidence limits are based on a faulty distribution and will be wrong. In this analysis we have calculated estimates on the transformed values in order to get a fair representation of the differences between provenances. Usually the figures are presented together with a raw mean to circumvent the problem with under-estimation.

4.9 Best Linear Unbiased Predictors (BLUPs - estimates from the random model)

In the random approach, the provenance effects are seen as coming from a normal distribution with an expected value and a variance. This is in opposition to the fixed effect approach, where the provenance effects are seen as constants. Estimating provenance effects in random models is more complicated than in fixed models, because the observed variation between provenances is contemplated as a mixture between true provenance effects and random error variation (*cf.* White & Hodge 1989). The variation between the provenances is therefore always larger than the true 'genetic' variation, except in cases where the error variation is negligible.

In order to predict the effect of a given provenance, it is necessary to correct the estimates for the part of the variance that is due to random error variation. This is done by calculating the best linear unbiased predictors (BLUPs, White & Hodge 1989). The calculation of BLUPs is cumbersome and only feasible with a suitable software package. In this case, the SAS procedure MIXED has been used. It follows from the above that the predicted values for the provenances fall within a smaller range than the least square means. Often the results are presented as deviations from the mean value to allow for easier comparison between different experiments. The deviations are expressed either in real values (m, cm^2 etc.) or in % deviation from the mean value. Here deviations are presented as % deviations from the mean values.

The problems with transformed values are the same as described for the least square means above. A further complication arises when calculating the deviations from the mean value in percent. If the mean value is calculated on the base of transformed values, and the deviations are calculated on the basis of this back-transformed mean, the deviations from the mean will not sum to zero. In this analysis, we have therefore chosen to base the deviations from the mean value on values calculated after transformation.

The BLUPs are presented with *t*-type confidence intervals. However, these should be interpreted with caution since it is probably wrong to assume that the underlying distribution of the estimates is normal because of the limited sample size (Littell et al. 1996). Confidence intervals are presented to give an impression of the variation between the provenances and should not be interpreted with respect to differences between provenances.

5. Results of statistical analysis of individual traits

The table below displays the traits selected for analysis, grouped into growth traits, adaptive traits and quality traits. For a full description of the traits and their calculation, please refer to Annex 4.

Group	**Trait description**	**Analysed trait**
Growth	Height growth	Height of tree with diameter corresponding to mean basal area (H_G)
	Diameter growth	Diameter of tree corresponding to mean basal area (D_G)
	Mean volume of tree	Average of volumes of trees in plot
	Standing volume per hectare	Volume per hectare
Adaptation	Survival	Survival percentage
	Cone setting	Average score of old, open cones
	Foxtailing	Foxtailing percentage
Quality	Stemform	Stemform score (1-9)
	Relative wood density (Pilodyn)	Diameter adjusted pilodyn readings
	Branching	Branch diameter - largest branch in whorl at 1/10 tree height

5.1 Survival

OVERVIEW OF ANALYSIS	
Co-variates	None
Data transformation required	Yes. Arc sin transformation
Weight statement	Yes
Outliers	None

RESULTS FROM ANALYSIS OF VARIANCE				
Effect	**DF**	**MS**	**F-value**	**P-value**
Provenance	35	2.46	2.75 (***)	0.0001
Block	5	0.24	0.27	0.93
Error	175	0.89		

Data has been transformed before analysis using an arc-sin transformation. This has been done to better fulfil the model assumptions (cf. Chapter 4). Even with the arc-sin transformation, the model assumptions (esp. normal distribution of residuals) are not too well fulfilled. The statistical analysis therefore has to be interpreted with caution.

The survival percentage is high – 100 per cent or close to 100 per cent – for most provenances. Highest survival (100 per cent) has the Philippine sources Mt. Province and Tarlac, the Thai sources Nam Now and Phu Kradung, and the controls 5/87 and m2012.

The statistical analysis reveals highly significant differences between seedlots, but because of the poor fit of the statistical model as mentioned above, these differences may not be real.

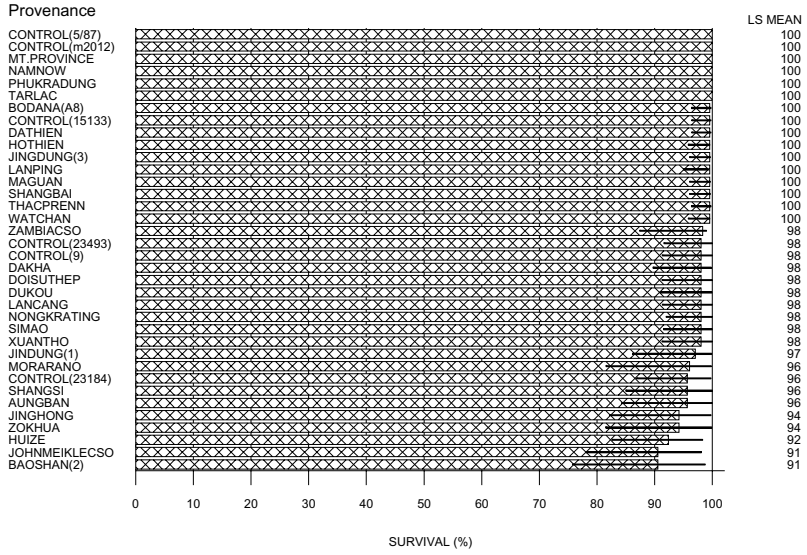
The poorest survival rate (but still above 90%) has the John Meikle CSO seedlot from Zimbabwe and the *P. yunnanensis* source Baoshan (2).

Pinus kesiya provenance trial, Grootgeluk, South Africa

International Series of Pinus kesiya provenance trials, Trial No. 4

Established February 1991. Assessed August 1998

Survival (%)

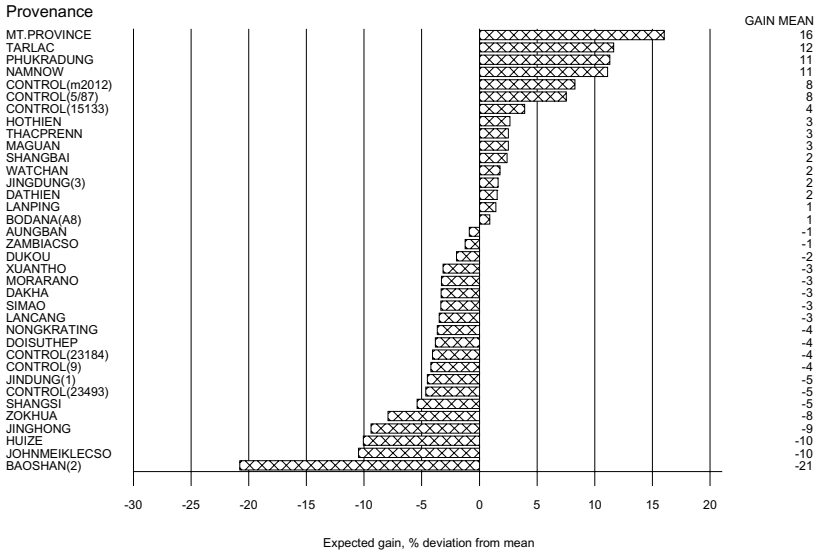


Pinus kesiya provenance trial, Grootgeluk, South Africa

International Series of Pinus kesiya provenance trials, Trial No. 4

Established February 1991. Assessed August 1998

Survival. Best linear un-biased predictors (BLUPs)



5.2 Height growth

OVERVIEW OF ANALYSIS	
Co-variates	None
Data transformation required	No
Weight statement	Yes
Outliers	None

RESULTS FROM ANALYSIS OF VARIANCE				
Effect	**DF**	**MS**	**F-value**	**P-value**
Provenance	35	55.64	54.38(***)	<0.0001
Block	5	8.08	7.89	<0.0001
Error	175	1.02		

There are highly significant differences between the seedlots in height growth.

The best performing *P. kesiya* sources are the Philippine sources Tarlac and Mt. Province (esp. Tarlac), the Madagascar landraces Morarano and Bodana(A8) which are probably of Vietnamese origin, and the Vietnamese sources. Best among the Vietnamese sources are Xuan Tho followed by Hothien, Thac Prenn, Da Kha and Dathien. Also the two seed orchard sources from Zambia and Zimbabwe are performing well. The controls 5/87 and m2012 have faster growth than the mentioned *P. kesiya* sources.

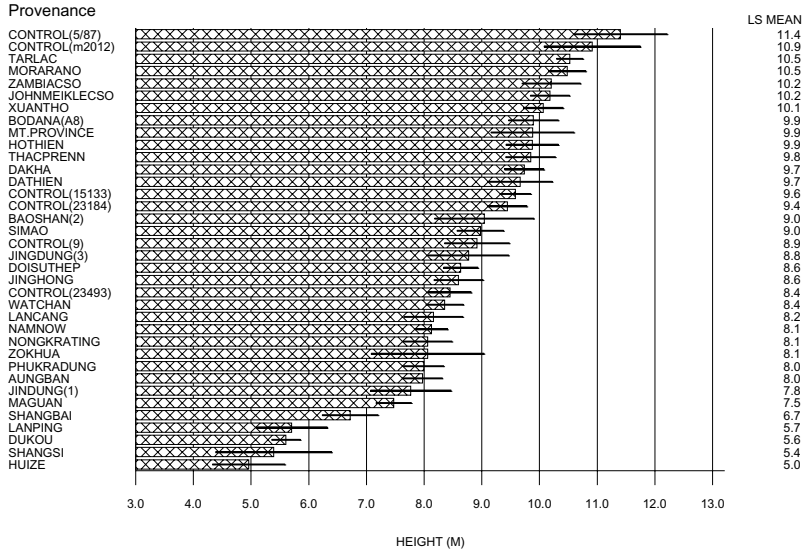
Thai and Chinese sources of *P. kesiya* are intermediate. Poorest performers are the *P. yunnanensis* sources, with Lanping, Dukou, Shangsi and Huize being particularly slow growing. These sources have heights less than half of the best performing provenances.

Pinus kesiya provenance trial, Grootgeluk, South Africa

International Series of Pinus kesiya provenance trials, Trial No. 4

Established February 1991. Assessed August 1998

Height (m)

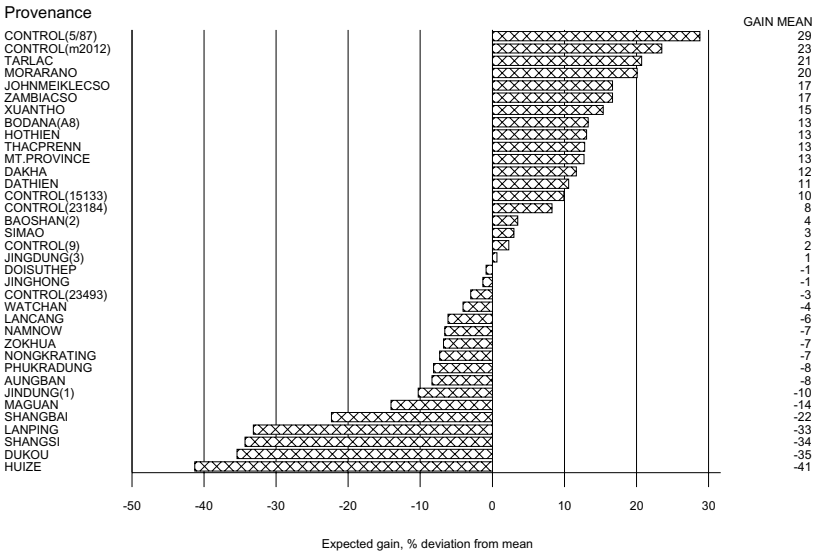


Pinus kesiya provenance trial, Grootgeluk, South Africa

International Series of Pinus kesiya provenance trials, Trial No. 4

Established February 1991. Assessed August 1998

Height. Best linear un-biased predictors (BLUPs)



5.3 Diameter growth

OVERVIEW OF ANALYSIS	
Co-variates	PLOTX2
Data transformation required	No
Weight statement	Yes
Outliers	None

RESULTS FROM ANALYSIS OF VARIANCE				
Effect	**DF**	**MS**	**F-value**	**P-value**
Provenance	35	22.68	22.63(***)	<0.0001
Block	5	4.07	4.06	0.0017
PLOTX2	1	6.89	6.87	0.0095
Error	174	1.00		

There are highly significant differences between seed lots in regard to diameter growth.

The best *P. kesiya* sources are the Madagascar sources Morarano and Bodana (A8). They are followed by Vietnamese sources Hothien, Xuan Tho, Thac Prenn and Da Kha. Also the Zambia CSO sources are among the top-performers.

The Philippine sources, Mt. Province and Tarlac, which were among the best in height growth, are not among the top sources in diameter. The slower diameter growth of the Philippine sources has also been experienced in other trials in the international series. Also the John Meikle CSO from Zimbabwe is ranked lower than in height.

The best diameter performance, however, has the 5/87 control. The m2012 control that was ranked high in height is ranked lower here.

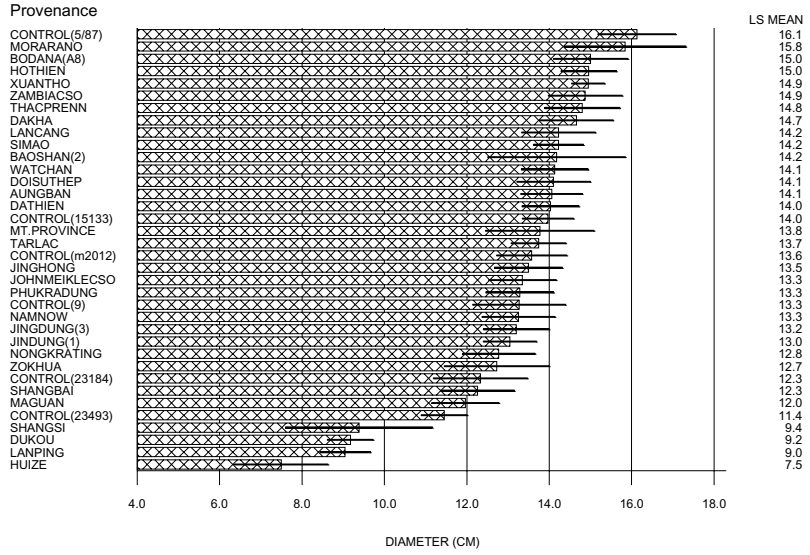
Chinese and Thai *P. kesiya* sources are intermediate. *P. yunnanensis* sources generally have very poor diameter growth.

Pinus kesiya provenance trial, Grootgeluk, South Africa

International Series of Pinus kesiya provenance trials, Trial No. 4

Established February 1991. Assessed August 1998

Diameter (cm)



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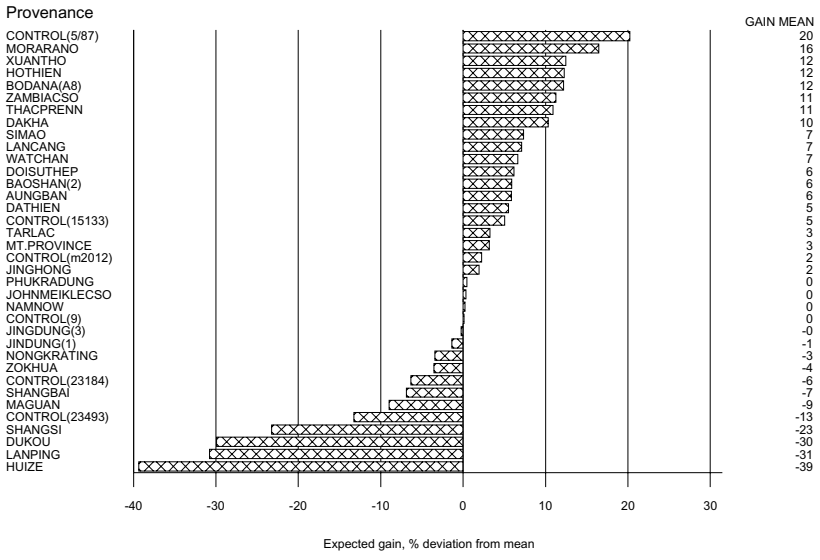
International Series of Pinus kesiya provenance trials, Trial No. 4

Established February 1991. Assessed August 1998

Diameter. Best linear un-biased predictors (BLUPs)



5.4 Mean volume of tree

OVERVIEW OF ANALYSIS	
Co-variates	None
Data transformation required	No
Weight statement	Yes
Outliers	None

RESULTS FROM ANALYSIS OF VARIANCE				
Effect	**DF**	**MS**	**F-value**	**P-value**
Provenance	35	47.46	46.34(***)	<0.0001
Block	5	6.94	6.79	<0.0001
Error	175	1.02		

Mean volume of tree is calculated as the average of the volumes of individual trees. As both height and diameter are included in the volume formula (cf. Annex 4), the trait thus illustrates a combined effect of height and diameter.

There are highly significant differences between seedlots.

The best performer is the 5/87 control. It is followed by the Madagascar landraces and Vietnamese sources. Also the Zambia CSO source is among the best. Morarano of Madagascar is the top source, followed by Xuan Tho of Vietnam and the Zambia CSO.

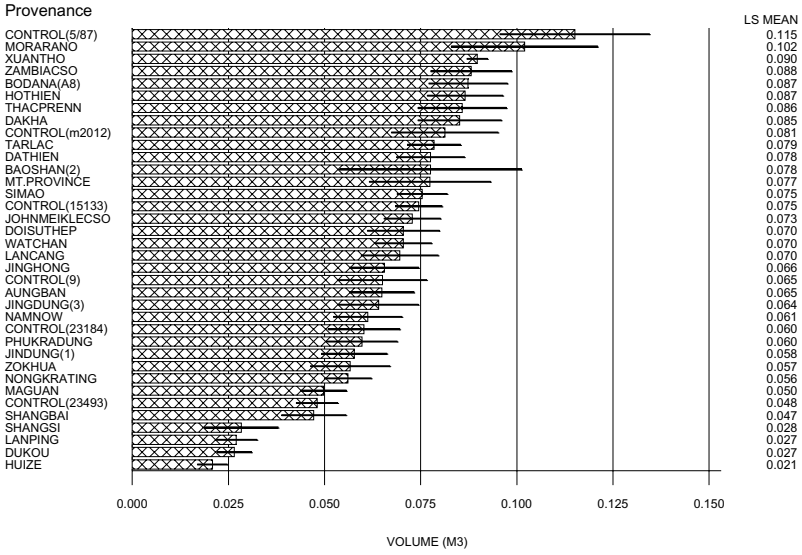
The Philippine sources (Tarlac and Mt. Province) are lower ranked because of the slower diameter growth as mentioned in 5.3.

Pinus kesiya provenance trial, Grootgeluk, South Africa

International Series of Pinus kesiya provenance trials, Trial No. 4

Established February 1991. Assessed August 1998

Volume of mean tree (m3)

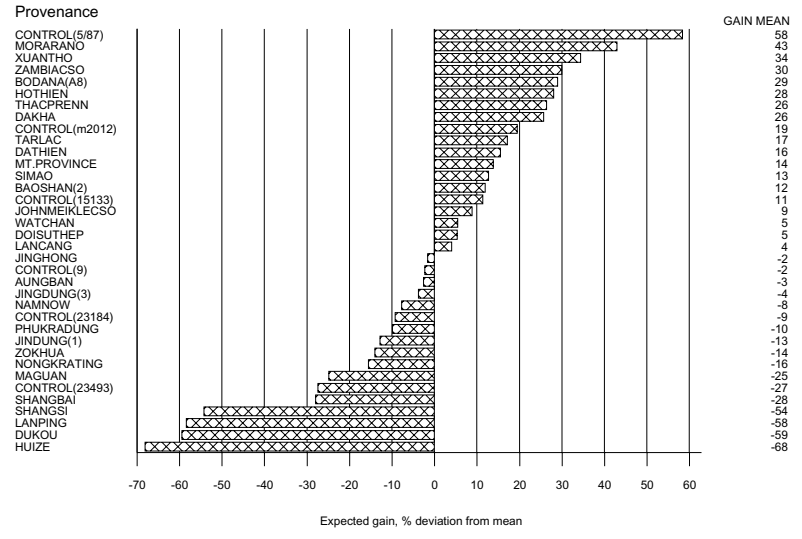


Pinus kesiya provenance trial, Grootgeluk, South Africa

International Series of Pinus kesiya provenance trials, Trial No. 4

Established February 1991. Assessed August 1998

Volume of mean tree. Best linear un-biased predictors (BLUPs)



5.5 Total volume per hectare

OVERVIEW OF ANALYSIS	
Co-variates	PLOTY2
Data transformation required	No
Weight statement	Yes
Outliers	None

RESULTS FROM ANALYSIS OF VARIANCE				
Effect	**DF**	**MS**	**F-value**	**P-value**
Provenance	35	45.54	45.03(***)	<0.0001
Block	5	7.02	6.94	<0.0001
PLOTY2	1	6.90	6.82	0.0098
Error	174	1.01		

The analysis of total volume production can be seen as an analysis summarising survival, height growth and diameter growth in one analysis as all three traits are included in the calculation.

There are highly significant differences among seedlots.

The ranking of seedlots is more or less identical to mean volume of tree (5.4). The 5/87 control has the best volume production followed by Madagascar sources (esp. Morarano), Vietnamese sources (esp. Xuan Tho and Hothien), and the Zambia CSO source.

The Philippine sources are ranked below the above-mentioned sources.

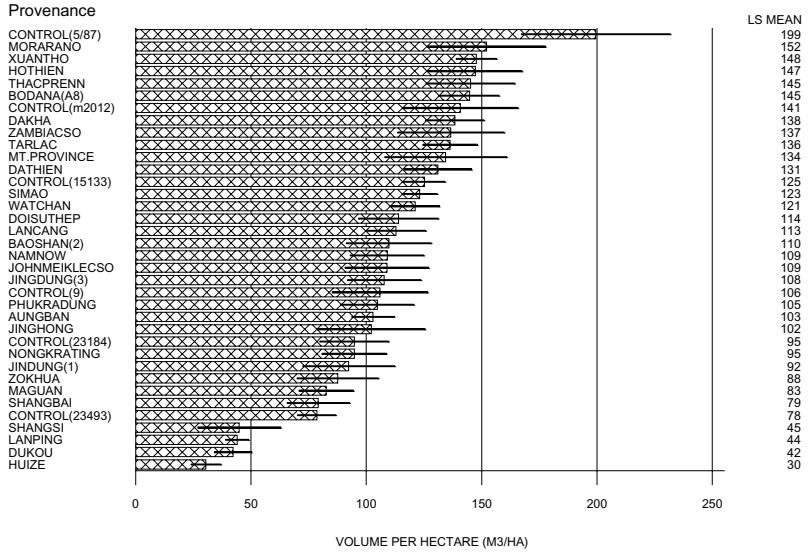
Chinese and Thai sources are intermediate, and Burmese sources and sources of *P. yunnanensis* have the poorest volume production.

Pinus kesiya provenance trial, Grootgeluk, South Africa

International Series of Pinus kesiya provenance trials, Trial No. 4

Established February 1991. Assessed August 1998

Volume per hectare (m3/ha)

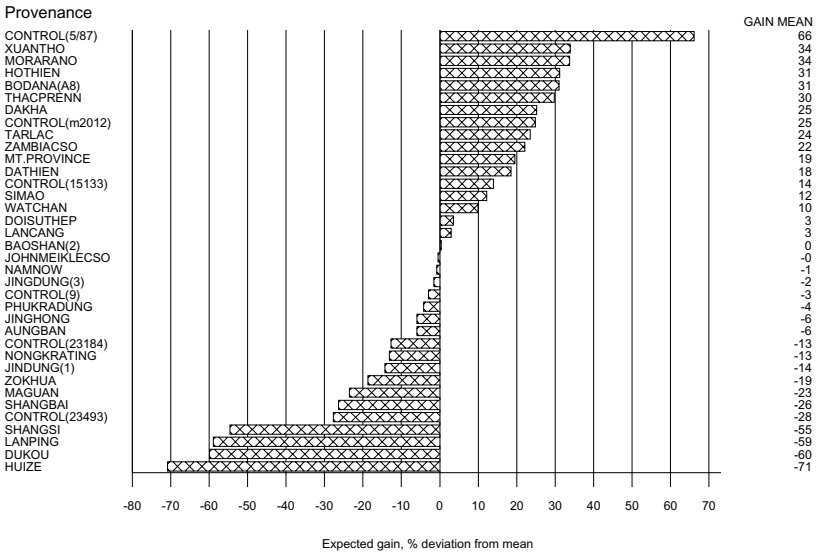


Pinus kesiya provenance trial, Grootgeluk, South Africa

International Series of Pinus kesiya provenance trials, Trial No. 4

Established February 1991. Assessed August 1998

Volume. Best linear un-biased predictors (BLUPs)



5.6 Stemform

OVERVIEW OF ANALYSIS	
Co-variates	None
Data transformation required	No
Weight statement	Yes
Outliers	None

RESULTS FROM ANALYSIS OF VARIANCE				
Effect	**DF**	**MS**	**F-value**	**P-value**
Provenance	35	37.80	37.09 (***)	<0.0001
Block	5	15.17	14.89	<0.0001
Error	175	1.02		

The statistical analysis reveals significant differences between provenances.

The controls are generally superior to the *P. kesiya* sources.

The best *P. kesiya* source is the Zambia CSO, which is comparable to the controls. Stemform has been a key trait in the selection of trees for the orchard, and the results indicate that this selection has been effective. The origin of the Zambia CSO source is not known, but is probably of Vietnamese or Philippine origin, or a mix with plus trees of both origins.

Also the Morarano landrace of Madagascar and the Thac Prenn source of Vietnam compare relatively well to the controls.

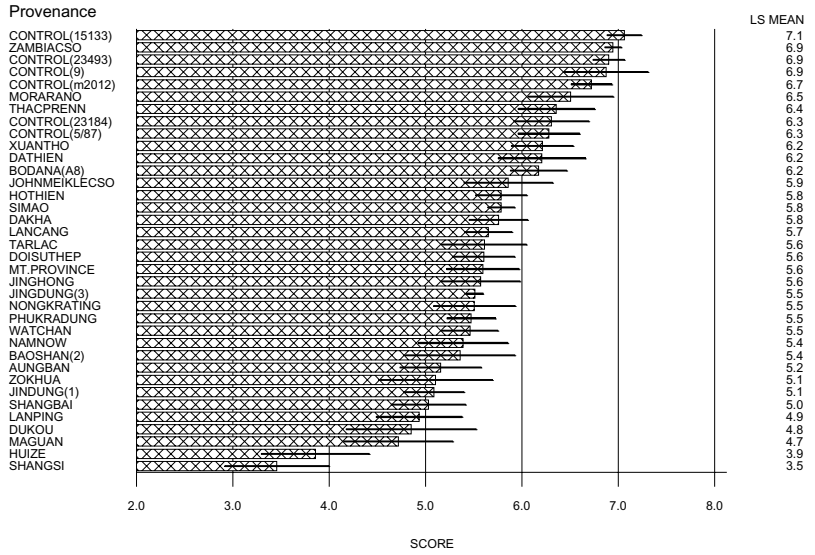
Overall, there is a fairly clear ranking of seedlots following geographical origin: The Madagascar landraces are best (esp. Morarano), closely followed by Vietnamese sources. They are followed by Philippine, Chinese, Thai, Burmese and sources of *P. yunnanensis* with poorer stemform in that order.

Pinus kesiya provenance trial, Grootgeluk, South Africa

International Series of Pinus kesiya provenance trials, Trial No. 4

Established February 1991. Assessed August 1998

Stemform (1-9 score)

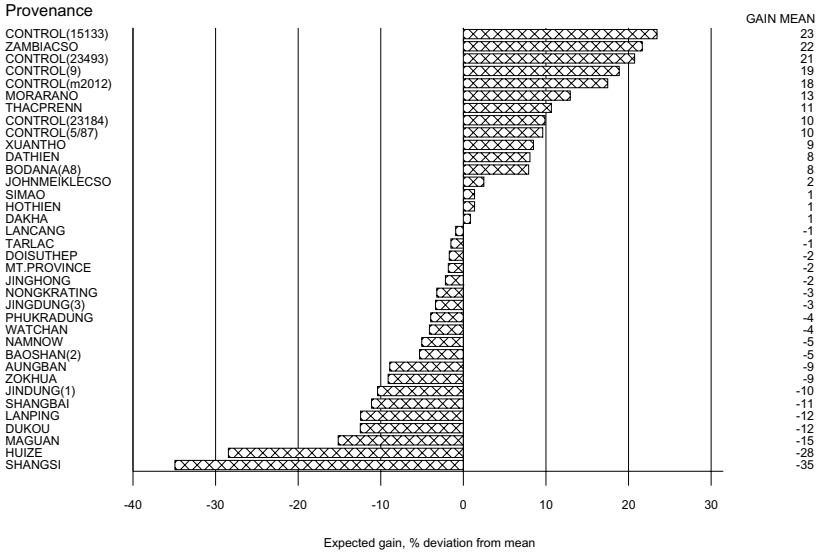


Pinus kesiya provenance trial, Grootgeluk, South Africa

International Series of Pinus kesiya provenance trials, Trial No. 4

Established February 1991. Assessed August 1998

Stemform. Best linear un-biased predictors (BLUPs)



5.7 Wood density (Pilodyn)

OVERVIEW OF ANALYSIS	
Co-variates	PLOTY2
Data transformation required	No
Weight statement	Yes
Outliers	Shangsi (Block 2)

RESULTS FROM ANALYSIS OF VARIANCE				
Effect	**DF**	**MS**	**F-value**	**P-value**
Provenance	35	14.37	14.23 (***)	<0.0001
Block	5	3.53	3.50	0.0049
PLOTY2	1	2.98	2.95	0.0874
Error	173	1.01		

Diameter adjusted pilodyn readings (ref. Annex 4) are used in the analysis. A low pilodyn reading corresponds to a high wood density, and *vice versa*.

The Shangsi source in Block 2 is omitted from the analysis because of the extreme nature of this plot (very low pilodyn reading) compared to other plots of the same seedlot. The plot value is a mean of only three trees (only three trees left in plot) whereof one tree has a very low reading.

The analysis of variance reveals highly significant differences among provenances.

Wat Chan and Phu Kradung of Thailand have the lowest pilodyn readings (corresponding to the highest wood densities). Also the other Thai provenances are above average. Above average is also the Chinese sources (esp. Lancang and Simao) and the Vietnamese sources (esp. Da Kha).

The Madagascar sources (Morarano and Bodana) are ranked lower than the Thai, Chinese and Vietnamese sources, with the Zambia CSO source ranked slightly better.

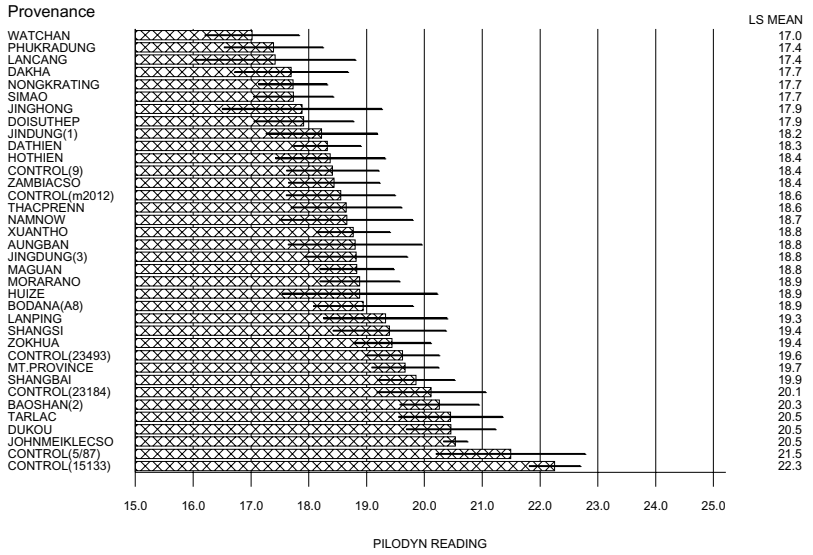
Below average are the Philippine sources and *P. yunnanensis* sources. Poorest wood density of all has the John Meikle CSO of Zimbabwe and the controls 5/87 and 15133.

Pinus kesiya provenance trial, Grootgeluk, South Africa

International Series of Pinus kesiya provenance trials, Trial No. 4

Established February 1991. Assessed August 1998

Pilodyn

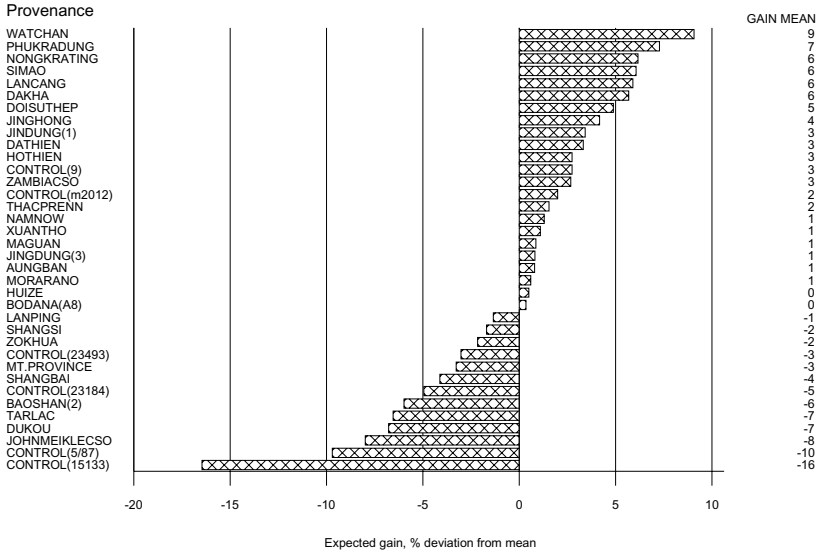


Pinus kesiya provenance trial, Grootgeluk, South Africa

International Series of Pinus kesiya provenance trials, Trial No. 4

Established February 1991. Assessed August 1998

Pilodyn. Best linear un-biased predictors (BLUPs)



5.8 Foxtailing

OVERVIEW OF ANALYSIS	
Co-variates	PLOTX, PLOTY, PLOTX2, PLOTY2
Data transformation required	No
Weight statement	Yes
Outliers	None

RESULTS FROM ANALYSIS OF VARIANCE				
Effect	**DF**	**MS**	**F-value**	**P-value**
Provenance	35	3.02	3.13 (***)	<0.0001
Block	5	4.34	4.50	0.0007
PLOTX	1	9.49	9.81	0.0020
PLOTY	1	5.75	5.94	0.0158
PLOTX2	1	9.93	10.27	0.0016
PLOTY2	1	6.66	6.89	0.0094
Error	171	0.96	0.97	

Analysis of frequency of foxtails gives an indication of the adaptability of the source to site (lower frequency means in general a better adaptation). Moreover, and of great practical importance, foxtails are related to the quality of the wood. Trees with foxtails often have ramicorns, i.e. thick branches from a lower whorl growing (co-evolving) vertically along with the main stem. They are able to develop as there are no whorls on the foxtail to suppress vertical growth of the branches. Trees with coarse branching are thus often a result of foxtails. This means lower quality, especially if timber is the final product. In addition, harvesting operations become more difficult. Apart from leading to coarse branching, foxtails will often result in broken stems as the wood of the foxtail is of low density.

There are significant differences among seedlots in regard to foxtail percentage. However, it is important to note the large size of the confidence intervals of many of the seed lots, indicating that there are only significant differences between top and low ranked provenances, whereas many of the differences within these groups are not statistically significant.

The John Meikle source (Zimbabwe) sets few foxtails as does the Morarano seedlot from Madagascar. The other seedlot from Madagascar, Bodana (A8), is below average.

Nam Now and Phu Kradung (Thailand) and Hothien and Thac Prenn (Vietnam) have many foxtails.

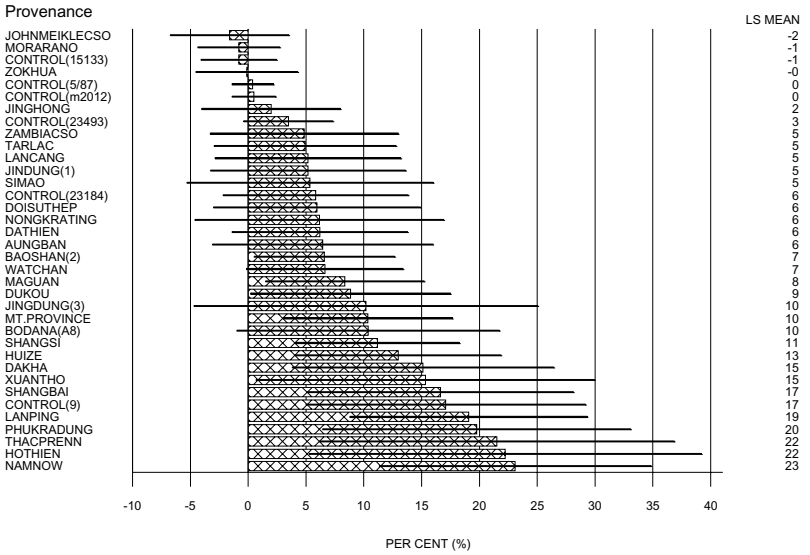
There seem to be no clear geographical patterns, as seen for other traits.

Pinus kesiya provenance trial, Grootgeluk, South Africa

International Series of Pinus kesiya provenance trials, Trial No. 4

Established February 1991. Assessed August 1998

Foxtail percentage (%)

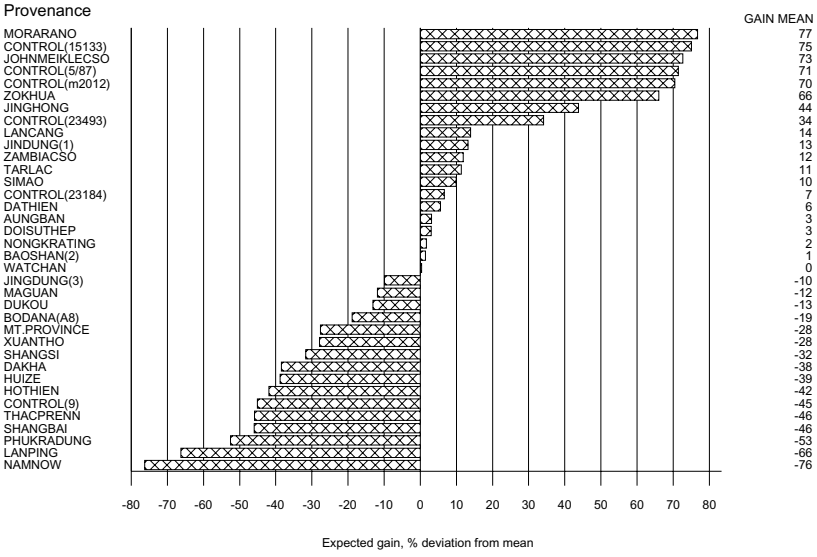


Pinus kesiya provenance trial, Grootgeluk, South Africa

International Series of Pinus kesiya provenance trials, Trial No. 4

Established February 1991. Assessed August 1998

Foxtailing. Best linear un-biased predictors (BLUPs)



5.9 Cone setting

OVERVIEW OF ANALYSIS	
Co-variates	PLOTX
Data transformation required	No
Weight statement	Yes
Outliers	None

RESULTS FROM ANALYSIS OF VARIANCE				
Effect	**DF**	**MS**	**F-value**	**P-value**
Provenance	35	36.28	36.46 (***)	<0.0001
Block	5	1.40	1.41	0.2240
PLOTX	1	4.72	4.74	0.0308
Error	174	1.00		

Data on flowering and fruiting provides an indication of the adaptation of the sources to site. Abundant flowering and fruiting is generally interpreted as a sign of good adaptation to the site, and *vice versa*.

As the trial is still young, only about 7 years of age at the time of assessment, flowering and fruiting may only have just commenced and the tested seedlots not expressing their full potential for flowering and fruiting. Consequently, the analysis should be interpreted with caution.

The analysed trait is average score of old, open cones. Assessments have been done using a 1-9 scale where score 1 refers to no flowers or cones. More details in DFSC (1998).

The analysis of variance shows highly significant differences among provenances in cone setting.

Most cones have the Jingdung (1) and (3) sources from China. Also the Burmese sources Aungban and Zok Hua have many cones together with the Madagascar land races (Morarano and Bodana).

The Thai and Vietnamese sources spread from above average to below average. The Philippine sources Mt. Province and Tarlac are intermediate.

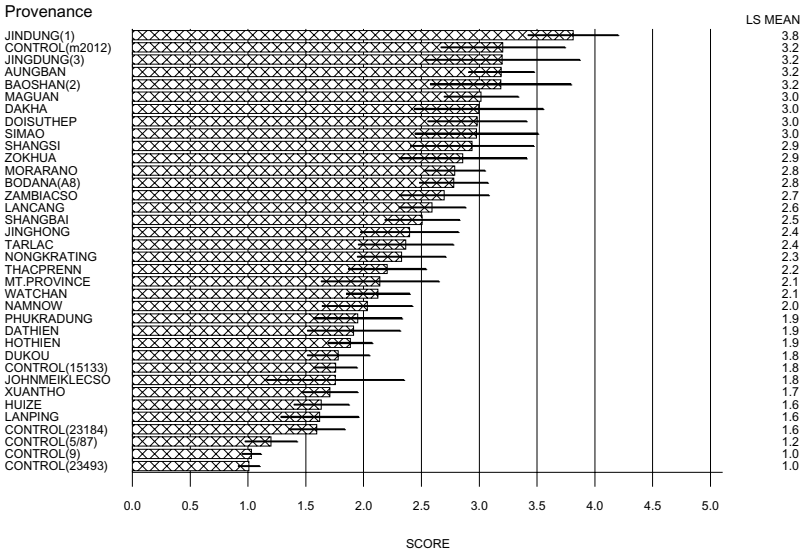
Few or very few cones were observed on many of the control seedlots, on the *P. yunnanensis* sources Huize and Lanping, on Xuan Tho of Vietnam and on the John Meikle source from Zimbabwe.

Pinus kesiya provenance trial, Grootgeluk, South Africa

International Series of Pinus kesiya provenance trials, Trial No. 4

Established February 1991. Assessed August 1998

Old, open cones (1-9 score)

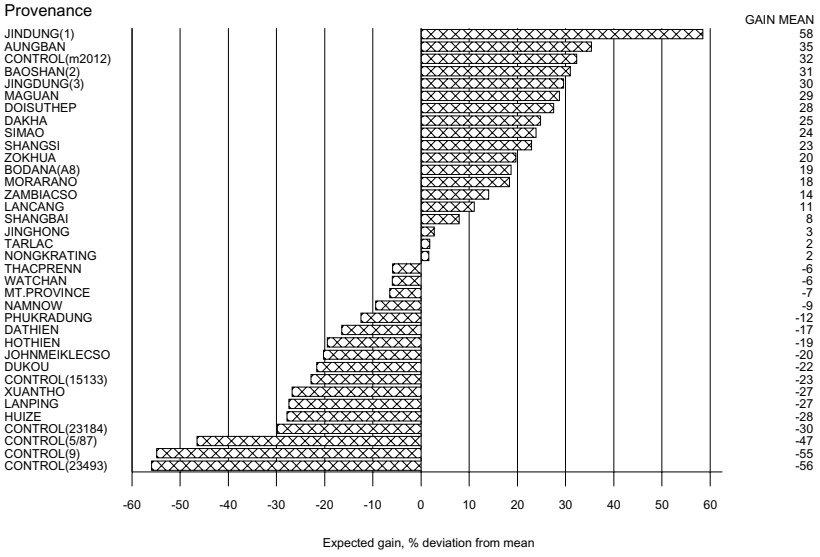


Pinus kesiya provenance trial, Grootgeluk, South Africa

International Series of Pinus kesiya provenance trials, Trial No. 4

Established February 1991. Assessed August 1998

Old, open cones. Best linear un-biased predictors (BLUPs)



5.10 Branch diameter

OVERVIEW OF ANALYSIS	
Co-variates	PLOTX and PLOTY
Data transformation required	No
Weight statement	Yes
Outliers	None

RESULTS FROM ANALYSIS OF VARIANCE				
Effect	**DF**	**MS**	**F-value**	**P-value**
Provenance	35	24.30	23.75 (***)	<0.0001
Block	5	5.33	5.20	0.0002
PLOTX	1	7.30	7.13	0.0083
PLOTY	1	7.09	6.93	0.0093
Error	173	1.02		

The analysis of variance reveals statistical significant differences between the tested sources.

The best *P. kesiya* sources are John Meikle CSO (Zimbabwe) and Mt. Province and Tarlac of the Philippines. Small branches have also the Zambia CSO source.

The Thai sources have slightly larger branches than the above sources, but branches are still below average.

Vietnamese and Madagascar sources are intermediate to slightly below average. The Chinese sources have large branch diameters. An exception is the Simao source with somewhat smaller branches.

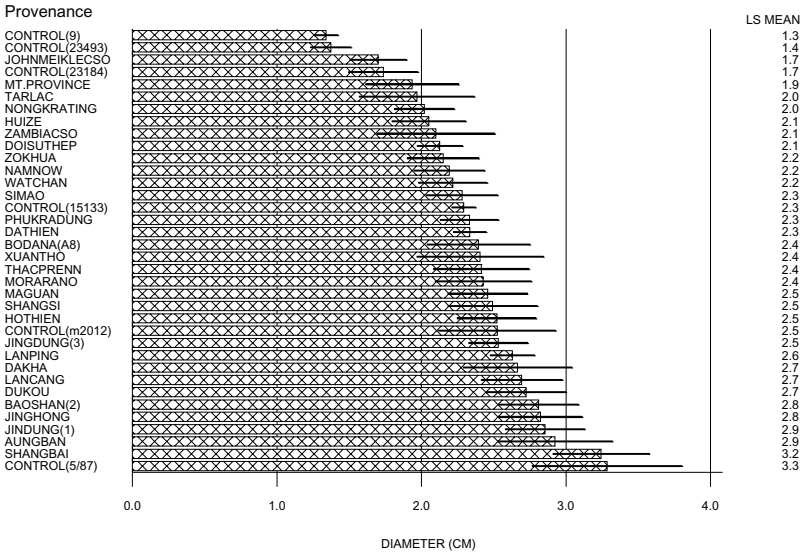
The controls 9 and 23493 have significantly smaller branches than the tested *P. kesiya* sources.

Pinus kesiya provenance trial, Grootgeluk, South Africa

International Series of Pinus kesiya provenance trials, Trial No. 4

Established February 1991. Assessed August 1998

Branch diameter (cm)

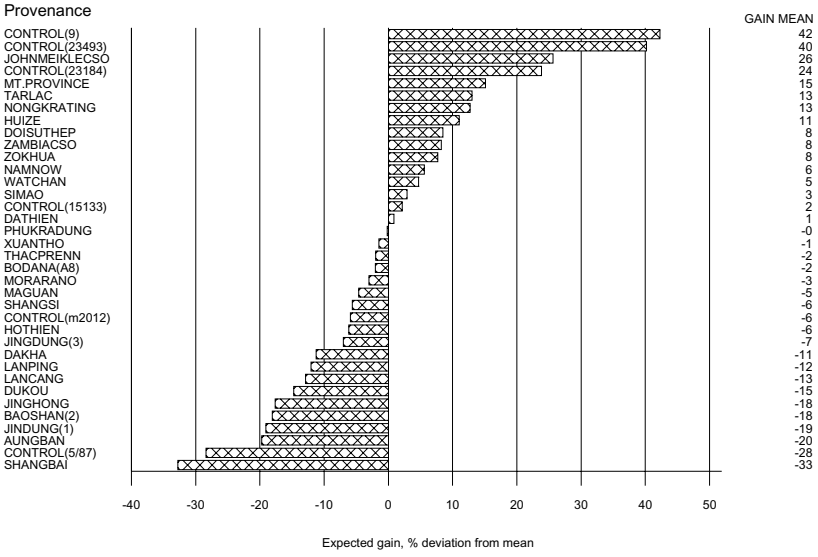


Pinus kesiya provenance trial, Grootgeluk, South Africa

International Series of Pinus kesiya provenance trials, Trial No. 4

Established February 1991. Assessed August 1998

Branch diameter. Best linear un-biased predictors (BLUPs)



6. Discussion and conclusions

6.1 Growth

When giving seed source (provenance) recommendations, results of the growth trait analysis should be weighted high because of the high importance of pulpwood production of the species.

None of the tested *P. kesiya* sources reach the height and diameter growth of the control 5/87, which over the 7 year trial period has produced about 50 m3/ha more wood than the best *P. kesiya* source.

The Madagascar (esp. Morarano) and Vietnamese sources are the best in regard to growth. There is not much difference in growth vigour (no statistical differences) among the tested Vietnamese sources, but the trial results indicate Xuan Tho, Hothien and Thac Prenn as the best.

Also the Zambia CSO source has a high volume production at the same level as the Vietnamese sources, and is generally a good choice of seed source, also considering the good stemform (see further discussion below).

The Philippine sources are also above average in growth, but have less growth vigour than the Madagascar and Vietnamese sources. The height growth is comparable to the Madagascar and Vietnamese sources, but diameter growth is slower making volume production lower than would be expected based on height alone.

The John Meikle CSO source from Zimbabwe is not among the top-ranking sources. As earlier mentioned, the seedlot originates from only one mother tree (clone) in the orchard, and this might explain the somewhat disappointing performance. A more representative seedlot, sampling all clones in the orchard, would probably perform better, but this needs to be confirmed in trials.

The Thai and Chinese sources are intermediate to below average. There is a rather large variation in the performance, best Thai source being the Doi Suthep and best Chinese source Simao, but generally they do not compare favourable to the above-mentioned sources.

The *P. yunnanensis* sources perform poorly and have no future potential on this type of sites. This is also true for the Aungban and Zokhua sources of *P. kesiya* from Myanmar.

Production potential, based on the best performing *P. kesiya* sources and based on growth in the first 7 years, is 20-22 m3/ha/year.

6.2 Adaptation

Adaptive traits include survival, frequencies of foxtails and cone setting.

In general the adaptive traits show no clear picture and no clear geographical patterns as seen for the growth characters.

Survival percentage is high for all provenances. The statistical analysis reveals significant differences, but the analysis has to be interpreted with caution, as model assumptions are not fulfilled. In any case, differences among top-ranking provenances are probably small.

The results on cone-setting should not be given too much importance. The trial is still young and cone-setting only starting. Furthermore there may be no obvious (direct) correlation between adaptation and cone setting. The statistical analysis reveals significant differences, but there is no clear pattern of variation.

Finally, the analysis of foxtails reveals significant differences, but again, with no clear pattern of variation.

6.3 Quality

Analyzed quality parameters are stemform, wood density (pilodyn) and branch diameter.

The general poor quality of *P. kesiya* with coarse branches and poor stemform is often referred as a key constraint for a further application of the species in plantation forestry. Improvement of quality would therefore be important in any future tree breeding.

The results (esp. the analysis of stemform and branch diameter) clearly illustrate the quality issue. The controls in general perform better than the *P. kesiya* sources.

The results, however, also clearly illustrates that quality improvements can be achieved by selection and tree breeding. The seedlot from the clonal seed orchard in Zambia compares well with the controls, and have significantly better stemform than all other *P. kesiya* sources. It is also among the best in branch diameter.

Among the un-improved sources, the Madagascar land races (esp. Morarano) perform well in stemform and better than the Vietnamese sources. They are again better than the Philippine ones. The Philippine sources, on the other hand, have smaller branches than the Madagascar and Vietnamese sources.

The Philippine sources have low wood density, which is surprising both considering the relatively slow diameter development of these sources and results from other trials where the Philippine sources have been among the best. Thai and Chinese sources are generally ranked high in wood density, and better than the Vietnamese and Madagascar sources. However, considering growth and other quality features (esp. stemform) of these sources, they cannot be recommended.

6.4 Conclusion

The trial is only 7 years of age, and it may thus be premature to draw very specific and detailed conclusions based on the present assessment. It is recommended that the trial is maintained, and re-assessed later on.

Based on the results of the present assessment, the Vietnamese and Madagascar sources are the most promising *P. kesiya* sources. They are fast-growing and they have relatively good quality characteristics. Best seedlots are Morarano of Madagascar and Xuan Tho, Thac Prenn and Hothien of Vietnam. There are only small differences among the Vietnamese sources, which all originate from a relatively restricted area in the Central Highlands of Vietnam.

The Vietnamese sources are generally recommended compared to Philippine sources because the trial results indicate a slightly higher production, and better stem form in the Vietnamese sources.

A good source for immediate seed supply is the Zambia CSO source. It is growing well, and has a good stemform. The performance of the other tested seed orchard offspring, John Meikle CSO of Zimbabwe cannot be judged from the present trial, as the tested seedlot is not representative of the orchard.

Other sources compare less favourable. This is especially true for the sources of *P. yunnanensis*, which have a very poor performance. The same holds for the Burmese sources of *P. kesiya*. The Thai and Chinese sources are generally of intermediate value, i.e. better than the *P. yunnanensis* but poorer than Vietnam, Madagascar and Philippine sources.

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Personal communication

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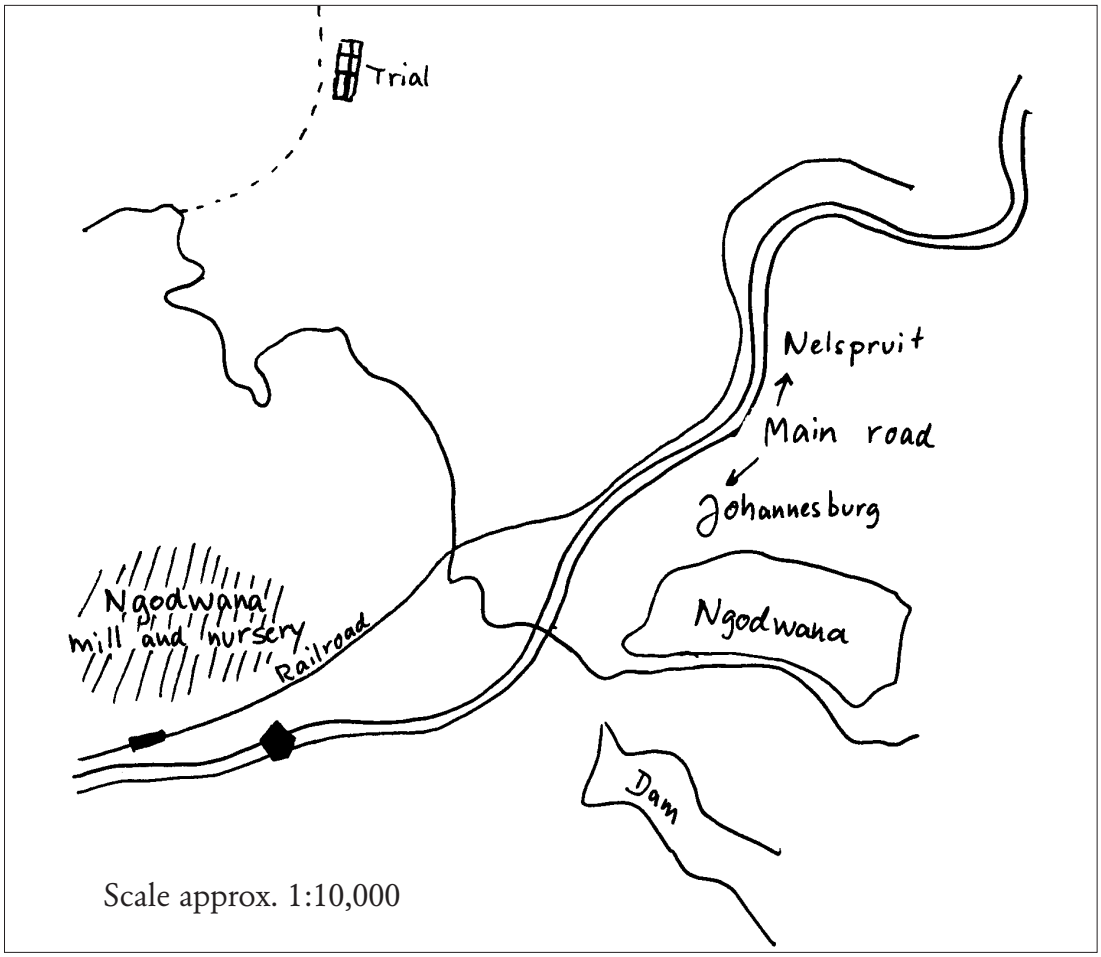
Annex 1. Trial design map



HIGHER ELEVATION ← *North*

Block 6			*Block 4*			*Block 2*		
90	←----------	61	90	←----------	61	90	←----------	61
31	----------→	60	31	----------→	60	31	----------→	60
30	←----------	1	30	←----------	1	30	←----------	1
90	←----------	61	90	←----------	61	90	←----------	61
31	----------→	60	31	----------→	60	31	----------→	60
30	←----------	1	30	←----------	1	30	←----------	1

Block 5			*Block 3*			*Block 1*			
90	←----------	61	60	←----------	31	30	←----------	1	PLOTX

----------ROAD----------

Randomisation						
			Block No.			
Line No.	rep1	rep2	rep3	rep4	rep5	rep6
1	70	85	6	5	86	137
2	66	84	5	7	92	136
3	68	91	7	13	90	133
4	110	88	9	11	91	134
5	69	81	14	4	79	138
6	13	93	13	10	88	135
7	9	79	15	9	81	110
8	10	74	10	6	93	68
9	7	86	11	14	94	70
10	15	90	12	12	83	66
11	12	73	4	16	85	69
12	14	94	4	15	73	79
13	5	83	3	44	84	74
14	6	92	1	53	74	92
15	11	69	138	49	65	88
16	4	110	137	51	60	91
17	16	68	136	71	54	93
18	3	66	134	48	64	83
19	1	70	135	50	56	84
20	136	33	133	52	57	85
21	135	35	44	45	59	90
22	137	20	52	35	110	86
23	133	42	50	19	70	81
24	138	39	48	30	66	94
25	134	72	53	25	69	73
26	92	19	45	33	68	35
27	74	41	71	21	25	38
28	94	38	51	72	38	40
29	91	21	49	38	42	72
30	79	29	121	20	35	33
31	83	40	97	29	32	30
32	88	30	125	42	72	39
33	85	25	132	41	33	32
34	84	32	130	22	41	21
35	86	22	120	32	40	22
36	90	1	119	39	29	20
37	93	3	100	40	22	19
38	81	13	105	60	39	41
39	73	14	118	65	20	42
40	39	9	111	54	21	25
41	30	15	112	57	30	29
42	33	7	99	56	19	16
43	40	5	78	64	106	12
44	20	6	106	59	132	9
45	19	4	104	3	115	13
46	32	12	122	1	100	14
47	25	16	115	137	112	11

Randomisation						
			Block No.			
Line No.	rep1	rep2	rep3	rep4	rep5	rep6
48	38	11	116	134	130	4
49	42	10	56	135	125	7
50	22	44	60	136	105	15
51	72	50	64	133	78	6
52	21	51	59	138	104	10
53	29	53	54	122	116	5
54	41	45	65	105	122	1
55	35	71	57	118	97	3
56	71	48	66	119	121	78
57	52	49	69	111	111	120
58	49	52	110	120	119	111
59	51	64	68	125	99	130
60	44	54	70	132	118	97
61	45	57	83	112	120	100
62	48	56	91	115	13	112
63	53	60	84	100	10	132
64	50	65	92	116	16	116
65	112	59	79	104	11	122
66	105	133	90	99	12	106
67	125	138	94	97	14	118
68	120	134	73	121	9	115
69	121	135	86	130	6	119
70	104	137	85	78	5	99
71	100	136	93	106	4	121
72	97	125	81	94	15	105
73	106	122	88	79	7	125
74	115	115	74	86	1	104
75	99	112	21	73	3	45
76	78	99	42	91	52	49
77	111	106	25	93	48	48
78	116	111	19	85	49	53
79	122	119	41	88	51	52
80	118	78	33	84	53	51
81	132	118	38	81	71	44
82	130	116	32	74	45	50
83	119	105	72	92	50	71
84	64	130	22	83	44	59
85	65	104	35	90	135	64
86	56	132	20	66	136	60
87	54	121	39	69	133	54
88	60	97	40	68	134	56
89	59	100	29	70	138	57
90	57	120	30	110	137	65

Family No.	Acc. No.	Name
1	1447/84	Mt. Province, Phillipines
3	1506/85	Tarlac, Philippines
4	1515/8500	Dathien, Vietnam
5	1516/8500	Xuan Tho, Vietnam
6	1517/8500	Hothien, Vietnam
7	1518/8500	VtThac Prenn, Vietnam
9	1519/8515	Single tree progeny
10	1519/8534	Single tree progeny
11	1519/8537	Single tree progeny
12	1519/8538	Single tree progeny
13	1519/8548	Single tree progeny
14	1519/8549	Single tree progeny
15	1519/8556	Single tree progeny
16	1519/8557	Single tree progeny
19	1521/8500	Nong Krating, Thailand
20	1522/8500	Doi Suthep, Thailand
21	1522/8502	Single tree progeny
22	1522/8503	Single tree progeny
25	1522/8507	Single tree progeny
29	1522/8520	Single tree progeny
30	1522/8521	Single tree progeny
32	1524/8500	Phu Kradung, Thailand
33	1525/8500	Nam Now, Thailand
35	1525/8503	Single tree progeny
38	1525/8508	Single tree progeny
39	1525/8510	Single tree progeny
40	1525/8511	Single tree progeny
41	1525/8512	Single tree progeny
42	1525/8513	Single tree progeny
72	1766/88-	Wat Chan, Thailand
44	1554/8501	Single tree progeny
45	1554/8502	Single tree progeny
48	1554/8505	Single tree progeny
49	1554/8506	Single tree progeny
50	1554/8507	Single tree progeny
51	1554/8508	Single tree progeny
52	1554/8509	Single tree progeny
53	1554/8510	Single tree progeny
71	1680/86	Dakha, Vietnam
54	1623/86	Shangbai, China
56	1625/86	Baoshan (2), China
57	1626/86	Maguan, China
59	1628/86	Huize, China
60	1629/86	Lan Ping, China
64	1633/86	Shangsi, China
65	1634/86	Dukou, China

Family No.	Acc. No.	Name
66	1635/86	Jingdung (1), China
69	1637/86	Jinhong, China
69	1638/86--1	Lancang, China
70	1639/86--3	Simao, China
110	1781/88	Jingdung (3), China
73	1772/8800	Zokhua, Burma
74	1772/8801	Single tree progeny
78	1772/8805	Single tree progeny
79	1772/8808	Single tree progeny
81	1772/8810	Single tree progeny
83	1772/8812	Single tree progeny
84	1773/8800	Aungban, Burma
85	1773/8801	Single tree progeny
86	1773/8802	Single tree progeny
88	1773/8805	Single tree progeny
90	1773/8807	Single tree progeny
91	1773/8808	Single tree progeny
92	1773/8809	Single tree progeny
93	1773/8810	Single tree progeny
94	1773/8811	Single tree progeny
97	1776/88	John Meikle CSO, Zimbabwe
99	1778/8800	CSO, Zambia
100	1778/8801	Single tree progeny
104	1778/8805	Single tree progeny
105	1778/8806	Single tree progeny
106	1778/8807	Single tree progeny
111	1782/8801	Single tree progeny
112	1782/8802	Single tree progeny
115	1782/8805	Single tree progeny
116	1782/8806	Single tree progeny
118	1782/8808	Single tree progeny
119	1782/8809	Single tree progeny
120	1782/8810	Single tree progeny
121	1783/88	Bodana A8, Madagascar
122	1786/8800	Morarano, Madagascar
125	1786/8803	Single tree progeny
130	1786/8809	Single tree progeny
132	1786/8815	Single tree progeny
133	15133	Control
134	23184	Control (P. kesiya)
135	5/87	Control
136	m2012	Control (P. patula)
137	9	Control (P. elliottii)
138	23493	Control (P. elliottii)

Annex 2. Trial description

Grootgeluk, South Africa

TRIAL ESTABLISHMENT AND MANAGEMENT

Year and month of establishment: *February 1991*

Area (ha): *1.9 ha*

Initial spacing (m x m): *2.4 m x 2.4 m*

Soil preparation (time, method/intensity): *Hand pitting*

Planting method(age of seedlings, type): *1 yr old seedlings grown in trays*

Beating up (time, %): *None*

Irrigation (time, amount): *None*

Fertilization (time, type, amount): *None*

Weeding (time, intensity): *Weeded twice during first year*

Thinning (time, intensity): *None*

Firelines: *None*

TRIAL DESIGN

Statistical design: *Randomized complete block design*

No. of replications (blocks): *6 replications*

No. of treatments (provenances): *90 seedlots (see list in Annex 1)*

Plot size (No. of trees in plot): *6 tree row plot*

Demarcation (blocks, plots): *Wood poles*

PROTECTION STATUS

Status (describe any disturbances/damages): *None*

Guarding (permanent, regular, none): *None*

Annex 3. Trial site description

LOCATION

Province: *Mpumalanga*
District: *Nelspruit*
Latitude (degrees and minutes): *25°34'S*
Longitude (degrees and minutes): *30°38'E*
Altitude (m above sea level): *1200 m above sea level*

Managing office/institution: *Grootgeluk Plantation – Sappi Forest Research*
Owner: *Sappi*
User(s): *Sappi*

Distance to nearest office responsible for management of the trial (km): *15 km*
Distance to nearest villages/towns (km): *15 km*
Number of inhabitants in the nearest villages/towns: *+/- 2500*

Type of area (e.g. research station, managed forest, etc.): *Managed forests*

CLIMATE

Nearest weather station:
Name of the station: Local information
Latitude (degrees and minutes):
Longitude (degrees and minutes):
Altitude (m a.s.l.):

Climatic data[1]	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
Rainfall (mm)	157.1	139.9	108.1	51.4	18.1	1.8	3.4	5.5	28.0	81.2	150.1	149.4	894.0
Temp. mean (°C)	2.1	20.9	19.9	18.0	15.1	12.7	126	146	168	187	196	204	175
Temp. mean max.[2] (°C)	26.3	26.1	25.4	24.0	22.3	20.4	20.3	22.2	24.2	25.3	25.2	26.0	-
Temp. mean min.[3] (°C)	15.7	15.3	14.5	14.5	11.9	8.1	5.0	4.9	6.8	9.5	12.4	14.9	-
Evapotranspiration[4] (mm)	.	.	.	.	.	.	.	.	.	.	.	.	.

[1] Period of observations Unknown [2] Average of daily maximum temperatures
[3] Average of daily minimum temperatures [4] Potential evapotranspiration (ETP) - Penman's formula

Rainy season:

Number/type of seasons: [x] one [ ] two [ ] even/irregular

Period(s): *6 months* (specify months)

Length of rainy season:
No. of intermediate days: (pre- and posthumid period of the growing season)
No. of wet days: (growing season)

Number of dry months per year (< 50 mm rain/month): *5 months*
Frost (number of days/year): *Occasional frost*
Prevailing winds (direction, period, speed):

TOPOGRAPHY (slope) of trial site

☐ Flat/gentle (0-8%) ☒ Intermediate (9-30%) ☐ Steep (>30%)

GENERAL SOIL DESCRIPTION

Soil texture		**Soil depth**		**Soil drainage/ n**		**Gravel content, topsoil**	
1. Light/sandy		1. Shallow (< 50 cm)	X	1. Well drained	X	1. None (< 15 %)	X
2. Medium/loamy	X	2. Deep (50-100 cm)		2. Seasonal		2. Gravelly (15-35 %)	
3. Heavy/clayey		3. Very deep (> 100 cm)		3. Permanent		3. Stony (> 35 %)	
Organic matter content		**Reaction (pH)**		**Soil salinity**		**Groundwater**	
1. Poor (< 2 % DM)	X	1. Acid (pH < 6.5)	X	1. None	X	1. Shallow (< 50 cm)	
2. Medium (2-5 % DM)		2. Neutral (6.5-7.5)		2. Moderate		2. Deep (50 - 150 cm)	X
3. Rich (> 5 %)		3. Alkaline (pH> 7.5)		3. High		3. Very deep (>150 cm)	

Specify soil unit, soil association and phases (subdivisions of soil units) according to the Soil map of the world (FAO-Unesco 1971-1979), if known: Lithosol

VEGETATION

Natural (original) vegetation type: *Grassland*

Dominant natural (original) genera/species:

Land use history:

RESULTS OF SOIL SAMPLE

Sample 1: Lower section of trial

Description	**Unit**	**Result**
Depth of sample	m	1.2
Clay (<2 µm)	%	46.6
Fine silt (2-20 µm)	%	27.5
Coarse silt (20-63 µm)	%	5.5
Fine sand (63-125 µm)	%	4.2
Fine medium sand (125-250 µm)	%	3.6
Coarse medium sand (250-500 µm)	%	4.5
Coarse sand (500-2000 µm)	%	8.1
Org. Mat.	%	3.6
Lime	%	0.0
pH-H_2O	-	4.74
P		- 1

Results noted as - 1: Amount not detectable

Sample 2: Upper part of trial

Description	**Unit**	**Result**
Depth of sample	m	1.2
Clay (<2 µm)	%	49.4
Fine silt (2-20 µm)	%	26.7
Coarse silt (20-63 µm)	%	2.7
Fine sand (63-125 µm)	%	3.3
Fine medium sand (125-250 µm)	%	4.5
Coarse medium sand (250-500 µm)	%	4.5
Coarse sand (500-2000 µm)	%	8.9
Org. Mat.	%	3.9
Lime	%	0.0
pH-H_2O	-	NA
P		- 1

Results noted as - 1: Amount not detectable

Annex 4. Plot data set

Aggregated data set at plot level. This annex describes the variables in the plot dataset, and displays the data. The plot data set has been prepared from the individual tree dataset (Annex 4) and holds the following parameters.

PARAMETER NAME	EXPLANATION
BLOCK	Block No.
SEEDLOT	Seedlot No.
PROVNAME	Name of seedlot/provenance
SITE	Name of site
DATEEST	Establishment data of trial (MM/YY)
DATEASS	Date of assessment (MM/YY)
PLOTX	Co-variate
PLOTY	Co-variate
PLOTX2	Co-variate
PLOTY2	Co-variate
DBH1	Average of diameters (arithmetic mean)
HEIGHT	Average height (arithmetic mean)
SURV	Survival percentage (%)
GMEAN	Mean basal area per tree (m2)
GSUM	Total basal area in plot (m2)
MEANPILO	Mean pilodyn for plot
WHORLS	Average number of whorls
BRANCH	Average number of branches in whorl
DIABRA	Diameter of largest branch (cm)
FORK	Frequency of trees with one or more forks (%)
FOXTAIL	Frequency of foxtails in plot (%)
NO_TOTAL	Number of trees in plot
NO_G	Number of trees in basal area calculation
NOHEIGHT	Number of trees in height-diameter regression
KRAFT1.. KRAFT5	Frequency of individual Kraft scores 1 to 5 (%)
KRAFT	Average Kraft index
STEM	Average stemform
STEM1..STEM9	Frequency of individual stemform scores 1 to 9 (%)
BRARATIO	Branch ratio (not calculated in this trial)
FO_INDEX	Forking index (not calculated in this trial)
INTNODE	Average distance between whorls (m)
CROWNPCT	Crown percentage (not calculated in this trial)
FO_POS	Average position of lower fork (m above ground)
TOP	Percentage of trees with broken top (not actual in this trial)
VTREE	Average volume of tree in plot
MF	Average score of male flowers
FF	Average score of female flowers
CL	Average score of conelets
CC	Average score of closed cones
OC	Average score of old, open cones
LOTH	Percentage of 'leaning trees' (not actual in this trial)
APHID	Percentage of trees with woolly aphid (not actual in this trial)
DG	Diameter corresponding to mean basal area at breast height (cm)
HG	Height for tree with diameter corresponding to mean basal area (m)
PILOCORR	Mean pilodyn reading adjusted for diameter effect
VHA	Volume per ha

DG- Diameter corresponding to mean basal area at breast height (1.3 m)

DG is calculated using the following formula:

$$DG = \left(\sqrt{\frac{\left(\sum_{i=1}^{n} \pi \times \left(Di/2 \right)^2 \right)}{n}} \Big/ \pi \right) \times 2$$

where
D_i is the diameter at breast height of tree No. i (in cm);
n is the total number of trees in plot.

GHA - Basal area per hectare

Basal area in m^2 per hectare is calculated using the formula:

$$GHA = \frac{\sum_{i=1}^{n} \pi \times \left(Di/2 \times 100 \right)^2}{n \times sp^2} \times 10000$$

where
D_i is the diameter at breast height of tree no. i (in cm);
n is the total number of trees in plot; and
sp is the spacing in m;

HG- Height of tree with diameter corresponding to mean basal area

A linear regression per plot is prepared using the model:

$$Height = \beta + \alpha \times \ln(DBH1)$$

where
DBH1 is the diameter of stem (first stem if more than one stem) in cm;
α is the slope of the regression line;
β is the intercept with y-axis;

For each plot, α and β are estimated using PROC REG (SAS 1990).

HG for the plot is then calculated using the linear regression estimates (α and β) and plot DG (as previously calculated).

PILOCORRR - Correction of pilodyn readings

Tree diameter (ring width) influences the pilodyn reading, i.e. trees with larger diameter (rings) will normally have larger pilodyn readings (deeper penetration of the pilodyn pin) than trees with smaller diameter, all other factors equal (ceteris paribus).

In order to adjust pilodyn readings for the variation in diameter, a correction factor has been introduced. By doing so, we are reducing the variance due to differences in individual tree size, and the provenances are in the subsequent analysis compared assuming that they have the same average tree size. In other words, we compare the level of the trait rather than the actual value.

The adjustment has been made using the GLM procedure in SAS (SAS 1990). The following model is applied:

. . .

```
PROC GLM;
CLASS plot;
MODEL pilo = plot DBH1;
LSMEANS plot  OUT=A;
```

. . .

Forking index (not used in the analysis of the present trial)

The forking index is calculated using the formula:

$$FO_INDEX = \frac{\sum_{i=1}^{n} FORK_i / FO_POS_i}{n}$$

where
$_{FORKi}$ is the number of forks observed on tree i
FO_POS_i is position above ground of first fork (in m) on tree i; and
n is the total number of trees with forking data in the plot

Branching index (not used in the analysis of the present trial)

The branching index is calculated using the formula:

$$BR_INDEX = \frac{\sum_{i=1}^{n} BRANCH_i \times DIABRA_i}{n \times 10}$$

where
$BRANCH_i$ is the number of branches on tree i;
$DIABRA_i$ is the branch diameter on tree i; and
n is the total number of trees with branching data in the plot.

INTNODE - Average distance between whorls

The INTNODE parameter is calculated using the formula:

$$INTNODE = \frac{\sum_{i=1}^{n} (HEIGHT_i - 0.5) / WHORLS_i}{n}$$

where

$HEIGHT_i$ is the height of tree i
$WHORLS_i$ is the number of whorls on tree i; and
n is the total number of trees with observations on whorls in the plot.

Plot Data Set - Grootgeluk

BLOCK	SEEDLOT	PROVENAM	SITE	DATESEAS	DATEASST	PLOTX	PLOTY	_TYPE	_FREQ	DBH	HEIGHT	SURVIV	GMEAN	GSUM	MEANPLOT	WHORLS	BRANCHES	DIAMETER	FORKTALL	NO_TOTAL	NO_HIGH	KRAFT1	KRAFT2	KRAFT3	KRAFT4	KRAFT5	KRAFTT	KRASTEM	STEM1	STEM2	STEM3	STEM4	STEM5	STEM6	STEM7	STEM8
1	01447/84	MT.PROVINCE	Grootgel	291	898	19	1	676	4	0	6	13.066667	10.916667	100	0.0157774	0.094664	19.333333	16	4.833333	1.766667	0.5	0	6	6	6	0	50	50	0	0	2.5	6.166667	0	0	0	0	0	83.333333	16.666667	0
1	01506/85	TARLAC	Grootgel	291	898	18	1	729	4	0	6	13.366667	10.85	100	0.01426229	0.085574	19.5	14.5	5.333333	1.933333	0	0	6	6	6	0	0	50	50	0	3.5	6.5	0	0	0	0	0	66.666667	16.666667	16.666667
1	01515/85	DATHIEN	Grootgel	291	898	16	1	841	4	0	6	12.76	9.52	83.333333	0.01758271	0.087914	19	12.4	4.8	2.4	0.4	0	6	5	5	0	20	80	0	0	2.8	6.4	0	0	0	0	0	0	60	40	0
1	01516/85	XUANTHO	Grootgel	291	898	13	1	1024	4	0	6	15.033333	9.95	100	0.0178606	0.107164	18.333333	12.6666667	5.166667	2.9	0.166667	0	6	6	6	0	16.666667	50	33.333333	0	3.166667	6.333333	0	0	0	0	0	66.666667	33.333333	0
1	01517/85	HOTHIEN	Grootgel	291	898	14	1	961	4	0	6	14.75	9.2666667	100	0.01961169	0.11767	17.333333	11	4.5	3.166667	0.5	0	6	6	6	0	16.666667	66.666667	16.666667	0	3	5.833333	0	0	0	0	0	16.6666667	83.333333	0	0
1	01518/85	THACPRENN	Grootgel	291	898	9	1	1296	4	0	6	13.933333	9.4333333	100	0.01538586	0.092315	19.833333	13.1666667	5.166667	2.1	0.166667	0	6	6	6	0	16.666667	16.666667	66.666667	0	3.5	6	0	0	0	0	0	16.6666667	66.666667	16.666667	0
1	01521/85	NONGKRATING	Grootgel	291	898	16	2	841	1	0	6	11.1	8.36	83.333333	0.01161254	0.058063	18.25	11.2	5.2	1.86	0.2	0	6	5	5	0	20	80	0	0	2.8	5.4	0	0	0	0	20	20	60	0	0
1	01522/85	DOISUTHEP	Grootgel	291	898	17	2	784	1	0	6	12.983333	8.4166667	100	0.01345601	0.080736	18.833333	13.5	5.333333	2.183333	0.5	0	6	6	6	0	16.666667	50	33.333333	0	3.166667	5.5	0	0	0	0	0	50	50	0	0
1	01524/85	PHUKRADUNG	Grootgel	291	898	15	2	900	1	0	6	12.5	7.7	100	0.0137534	0.08252	17.166667	13.5	5.333333	2.55	0.166667	0	6	6	6	0	16.666667	33.333333	50	0	3.333333	5.666667	0	0	0	0	16.666667	0	83.333333	0	0
1	01525/85	NAMNOW	Grootgel	291	898	19	2	676	1	0	6	12.683333	8.1666667	100	0.01648494	0.09891	18.333333	13.8333333	5.333333	2.216667	0.333333	0	6	6	6	0	0	83.333333	16.666667	0	3.166667	6	0	0	0	0	0	16.6666667	66.666667	16.666667	0
1	01623/86	SHANGBAI	Grootgel	291	898	27	3	324	0	0	6	10.616667	5.9833333	100	0.01215539	0.072932	18.833333	5.16666667	5.5	3.733333	0.5	50	6	6	6	0	16.666667	83.333333	0	0	2.833333	5.666667	0	0	0	0	0	33.3333333	66.666667	0	0
1	01625/86	BAOSHAN(2)	Grootgel	291	898	26	3	361	0	0	6	9.88	7.58	83.333333	0.0116853	0.058427	20.4	11.8	3.2	2.56	0.6	20	6	5	5	0	0	40	40	20	3.8	6	0	0	0	0	0	20	60	20	0
1	01626/86	MAGUAN	Grootgel	291	898	30	3	225	0	0	6	10.2	7.1666667	100	0.01067327	0.06404	18	10.5	4.333333	2.716667	0.5	33.333333	6	6	6	0	33.33333	50	16.666667	0	2.833333	5.833333	0	0	0	0	0	16.6666667	83.333333	0	0
1	01628/86	HUIZE	Grootgel	291	898	29	3	256	0	0	6	7	4.66	83.333333	0.00589804	0.02949	16.333333	4.6	4.6	2.36	0.6	20	6	5	5	0	60	40	0	0	2.4	3.4	0	60	0	0	0	20	20	0	0
1	01629/86	LANPING	Grootgel	291	898	28	3	289	0	0	6	7.6666667	4.4833333	100	0.00562035	0.033722	17	6.16666667	4.5	2.616667	0.333333	50	6	6	6	0	100	0	0	0	2	5.333333	0	0	16.666667	0	0	16.6666667	66.666667	0	0
1	01633/86	SHANGSI	Grootgel	291	898	24	3	441	0	0	6	10.633333	6.2666667	100	0.01095561	0.065734	19.333333	7.33333333	4.5	3.05	0.166667	33.333333	6	6	6	0	50	33.333333	0	16.666667	2.833333	4	0	16.666667	50	0	0	16.6666667	16.666667	16.666667	0
1	01634/86	DUKOU	Grootgel	291	898	25	3	400	0	0	6	7.9666667	5.1666667	100	0.00658887	0.039533	19.6	5	5.166667	2.733333	0.5	33.333333	6	6	6	16.66667	50	33.333333	0	0	2.166667	5.333333	0	0	0	0	16.666667	33.3333333	50	0	0
1	01635/86	JINDUNG(1)	Grootgel	291	898	2	1	1849	4	0	6	11.916667	7.9666667	100	0.01440018	0.086401	19.333333	10.3333333	5.666667	2.633333	0.666667	0	6	6	6	0	33.33333	50	16.666667	0	2.833333	5.333333	0	0	0	0	16.666667	33.3333333	50	0	0
1	01637/86	JINGHONG	Grootgel	291	898	3	1	1764	4	0	6	13.28	8.7	83.333333	0.01424249	0.071212	18.8	11.8	5.6	3.06	0	0	6	5	5	0	20	40	40	0	3.2	5	0	0	0	0	20	60	20	0	0
1	01638/86	LANCANG	Grootgel	291	898	5	1	1600	4	0	6	12.466667	8.65	100	0.01501408	0.090085	17.166667	11.5	3.833333	2.8	1.166667	0	6	6	6	0	50	33.333333	16.666667	0	2.666667	6	0	0	0	0	16.6666667	66.666667	16.666667	0
1	01639/86	SIMAO	Grootgel	291	898	1	1	1936	4	0	6	12.666667	8.5833333	100	0.01684598	0.101076	17.166667	12.1666667	4.5	2.1	0.666667	0	6	6	6	0	16.666667	66.666667	16.666667	0	3	6.166667	0	0	0	0	0	16.6666667	50	33.333333	0
1	01680/86	DAKHA	Grootgel	291	898	5	2	1600	1	0	6	14.916667	9.9166667	100	0.01761689	0.105701	17.333333	12.8333333	5.166667	2.75	0.166667	16.666667	6	6	6	0	0	33.333333	66.666667	0	3.666667	6.166667	0	0	0	0	0	16.6666667	50	33.333333	0
1	01766/88	WATCHAN	Grootgel	291	898	10	2	1225	1	0	6	11.833333	8	100	0.01474956	0.088497	17.5	10.6666667	5.833333	2.4	0.833333	0	6	6	6	0	0	83.333333	16.666667	0	3.166667	5.833333	0	0	0	0	0	16.6666667	83.333333	0	0
1	01772/88	ZOKHUA	Grootgel	291	898	22	2	529	1	0	6	10.483333	7.4166667	100	0.0144777	0.086866	20.5	13.3333333	4.833333	2.333333	0.833333	0	6	6	6	0	0	33.333333	50	16.666667	3.833333	5.333333	0	0	16.666667	16.666667	0	50	16.666667	0
1	01773/88	AUNGBAN	Grootgel	291	898	27	2	324	1	0	6	12.883333	7.95	100	0.0143842	0.086305	19.666667	10.3333333	5.166667	3.15	0.5	0	6	6	6	0	0	66.666667	33.333333	0	3.333333	4.833333	0	0	0	0	50	16.6666667	33.333333	0	0
1	01776/88	JOHNMEIKLECSO	Grootgel	291	898	12	3	1089	0	0	6	11.28	9.26	83.333333	0.01223546	0.061177	20.6	17.2	4.6	1.94	0.2	0	6	5	5	0	60	40	0	0	2.4	6.2	0	0	0	0	0	0	80	20	0
1	01778/88	ZAMBIACSO	Grootgel	291	898	15	3	900	0	0	6	16.7	9.4333333	50	0.02192693	0.065781	20	17.3333333	4.333333	2.133333	0.333333	0	6	3	3	0	0	66.666667	33.333333	0	3.333333	7.333333	0	0	0	0	0	0	0	66.666667	33.333333
1	01781/88	JINGDUNG(3)	Grootgel	291	898	4	1	1681	4	0	6	12.65	8.8666667	100	0.01287799	0.077268	18.5	11.1666667	5.166667	2.433333	0	0	6	6	6	0	0	100	0	0	3	5.833333	0	0	0	0	0	33.3333333	50	16.666667	0
1	01783/88	BODANA(A8)	Grootgel	291	898	9	3	1296	0	0	6	13.1	9.2833333	100	0.01606576	0.096395	20	13.6666667	4.833333	2.2	0.5	16.666667	6	6	6	0	0	66.666667	33.333333	0	3.333333	6	0	0	0	0	16.666667	0	50	33.333333	0
1	01786/88	MORARANO	Grootgel	291	898	19	3	676	0	0	6	15.833333	9.9333333	50	0.02845621	0.085369	20	13	4	2.966667	1	0	6	3	3	0	0	33.333333	66.666667	0	3.666667	6.333333	0	0	0	0	0	66.666667	33.333333	0	0
1	15133	CONTROL(15133)	Grootgel	291	898	23	1	484	4	0	6	14.48	9.6	83.333333	0.01669014	0.083451	22.4	19	5.2	2.48	0	0	6	5	5	0	0	80	20	0	3.2	7.2	0	0	0	0	0	0	20	40	40
1	23184	CONTROL(23184)	Grootgel	291	898	25	1	400	4	0	6	11.66	8.38	83.333333	0.01232754	0.061638	21.25	16.4	4.8	1.84	0.4	0	6	5	5	0	40	20	40	0	3	6.6	0	0	0	0	0	0	60	20	20
1	23493	CONTROL(23493)	Grootgel	291	898	24	1	441	4	0	6	12.48	8.8	83.333333	0.01242937	0.062147	20.6	16.2	3.6	1.28	0	0	6	5	5	0	20	80	0	0	2.8	7	0	0	0	0	0	0	0	100	0
1	5/87	CONTROL(5/87)	Grootgel	291	898	21	1	576	4	0	6	14.866667	10.866667	100	0.0177286	0.106372	19	15.6666667	3.833333	2.833333	0	0	6	6	6	0	16.666667	50	33.333333	0	3.166667	7.166667	0	0	0	0	0	0	0	83.333333	16.666667
1	9	CONTROL(9)	Grootgel	291	898	22	1	529	4	0	6	12.62	8.58	83.333333	0.01256656	0.062833	19	14.8	3.6	1.42	0	0	6	5	5	0	80	20	0	0	2.2	6.2	0	0	0	0	0	0	80	20	0
1	m2012	CONTROL(m2012)	Grootgel	291	898	20	1	625	4	0	6	13.1	11.733333	100	0.01508035	0.090482	19.833333	22.3333333	4.166667	2.233333	0.333333	0	6	6	6	0	33.333333	16.666667	50	0	3.166667	6.5	0	0	0	0	0	16.6666667	33.333333	33.333333	16.666667
2	01447/84	MT.PROVINCE	Grootgel	291	898	25	5	400	4	0	6	13.75	10.1	100	0.01513482	0.090809	19.5	14	4.166667	2.566667	0.5	33.333333	6	6	6	0	0	33.333333	33.333333	33.333333	4	5.4	0	0	0	0	20	20	60	0	0
2	01506/85	TARLAC	Grootgel	291	898	24	5	441	4	0	6	12.6	10.4	100	0.01273774	0.076426	19	15.1666667	5	1.833333	0.166667	33.333333	6	6	6	0	0	50	50	0	3.5	6.333333	0	0	0	0	16.666667	0	16.666667	66.666667	0
2	01515/85	DATHIEN	Grootgel	291	898	16	5	841	4	0	6	12.266667	9.8333333	100	0.01222624	0.073357	18.166667	12.3333333	5.833333	2.016667	0	0	6	6	6	0	16.666667	66.666667	16.666667	0	3	5.666667	0	16.666667	0	0	0	16.6666667	16.666667	50	0
2	01516/85	XUANTHO	Grootgel	291	898	18	5	729	4	0	6	13.5	10.033333	100	0.01558752	0.093525	18	13	4.833333	1.966667	0.166667	33.333333	6	6	6	0	0	50	50	0	3.5	6.333333	0	0	0	0	0	16.6666667	50	16.666667	16.666667
2	01517/85	HOTHIEN	Grootgel	291	898	17	5	784	4	0	6	13	9.8833333	100	0.01489426	0.089366	17.166667	11.6666667	5.166667	2.05	0.166667	16.666667	6	6	6	0	0	50	50	0	3.5	5.833333	0	0	0	0	0	33.3333333	50	16.666667	0
2	01518/85	THACPRENN	Grootgel	291	898	19	5	676	4	0	6	14.866667	10.4	100	0.01741929	0.104516	19.166667	12.1666667	5.166667	2.433333	0	66.666667	6	6	6	0	0	50	50	0	3.5	6.5	0	0	0	0	0	16.6666667	33.333333	33.333333	16.666667
2	01521/85	NONGKRATING	Grootgel	291	898	26	4	361	1	0	6	12.05	7.6166667	100	0.01390335	0.08342	17.166667	11.6666667	4.333333	2.35	0.333333	16.666667	6	6	6	0	16.666667	66.666667	16.666667	0	3	6.5	0	0	0	0	0	0	50	50	0
2	01522/85	DOISUTHEP	Grootgel	291	898	22	4	529	1	0	6	12.75	8.6333333	100	0.0175319	0.105191	19.833333	13	5	2.1	0.333333	0	6	6	6	0	0	33.333333	66.666667	0	3.666667	5.833333	0	0	0	0	0	16.6666667	83.333333	0	0
2	01524/85	PHUKRADUNG	Grootgel	291	898	27	5	324	4	0	6	10.966667	7.45	100	0.0120704	0.072422	17.833333	12	5	2.033333	0.333333	50	6	6	6	0	33.333333	50	16.666667	0	2.833333	5.666667	0	0	0	0	0	33.3333333	66.666667	0	0
2	01525/85	NAMNOW	Grootgel	291	898	20	4	625	1	0	6	12.85	8.7833333	100	0.01377606	0.082656	20.333333	13.8333333	5.5	2.05	0.166667	33.333333	6	6	6	0	0	50	50	0	3.5	5.5	0	0	0	0	0	16.666667	16.666667	66.666667	0	0
2	01623/86	SHANGBAI	Grootgel	291	898	1	5	1936	4	0	6	9.1833333	6.6166667	100	0.01195857	0.071751	20.5	5	3.833333	2.466667	1	0	6	6	6	0	0	100	0	0	3	5	0	0	0	0	50	0	50	0	0
2	01625/86	BAOSHAN(2)	Grootgel	291	898	2	6	1849	9	0	6	13.02	8.92	83.333333	0.01766144	0.088307	21.6	13	5	2.92	0.4	0	6	5	5	0	0	60	40	0	3.4	6.2	0	0	0	0	0	0	80	20	0
2	01626/86	MAGUAN	Grootgel	291	898	1	6	1936	9	0	6	8.6833333	6.4333333	100	0.00831993	0.04992	18.6	9.3333333	3.666667	1.816667	0.5	0	6	6	6	16.6667	16.66667	66.66667	0	0	2.5	4.166667	0	16.666667	0	0	50	16.666667	16.666667	0	0
2	01628/86	HUIZE	Grootgel	291	898	5	6	1600	9	0	6	6.6166667	4.7333333	100	0.0040937	0.024562	18	4.3333333	5	2.45	0.166667	0	6	6	6	50	16.66667	33.333333	0	0	1.833333	3.166667	0	0	50	16.666667	16.666667	0	16.666667	0	0
2	01629/86	LANPING	Grootgel	291	898	3	6	1764	9	0	6	8.54	5.78	83.333333	0.00820867	0.041043	18.25	4.6	4	2.78	0.8	0	6	5	5	20	40	40	0	0	2.2	4.6	0	0	40	0	20	40	0	0	0
2	01633/86	SHANGSI	Grootgel	291	898	2	5	1849	4	0	6	7.9	4.52	83.333333	0.00526381	0.026319	12.666667	6	4.8	1.86	0	0	6	5	5	0	60	40	0	0	2.4	3.2	0	40	20	20	20	0	0	0	0
2	01634/86	DUKOU	Grootgel	291	898	4	6	1681	9	0	6	9.4833333	5.5333333	100	0.00824424	0.049465	19.166667	4.83333333	4.833333	2.866667	0.333333	0	6	6	6	0	16.666667	83.333333	0	0	2.833333	5.833333	0	0	0	0	0	16.666667	83.333333	0	0
2	01635/86	JINDUNG(1)	Grootgel	291	898	18	4	729	1	0	6	12.2	8.2833333	100	0.01343454	0.080607	17.666667	11.1666667	4.833333	2.266667	0.5	0	6	6	6	0	0	83.333333	16.666667	0	3.166667	5.333333	0	0	0	0	0	66.666667	33.333333	0	0
2	01637/86	JINGHONG	Grootgel	291	898	17	4	784	1	0	6	12.2	8.5	100	0.0117514	0.070508	17.5	12.1666667	5.166667	2.283333	0.166667	0	6	6	6	0	0	66.666667	33.333333	0	3.333333	5.833333	0	0	0	0	0	16.6666667	83.333333	0	0
2	01638/86	LANCANG	Grootgel	291	898	15	4	900	1	0	6	13.433333	8.3	100	0.01660018	0.099601	19.666667	12.1666667	5.166667	2.483333	0.5	0	6	6	6	0	0	50	50	0	3.5	5.666667	0	0	0	0	0	16.666667	16.666667	50	16.666667	0
2	01639/86	SIMAO	Grootgel	291	898	19	4	676	1	0	6	11.283333	8.1833333	100	0.01517751	0.091065	17.666667	11.8333333	5	1.85	0.833333	0	6	6	6	0	0	83.333333	16.666667	0	3.166667	6	0	0	0	0	0	0	0	100	0	0
2	01680/86	DAKHA	Grootgel	291	898	6	5	1521	4	0	6	15.46	10.34	83.333333	0.01942899	0.097145	17.4	12.2	4.8	3.04	0.2	20	6	5	5	0	20	20	60	0	3.4	5.8	0	0	0	0	0	20	80	0	0
2	01766/88	WATCHAN	Grootgel	291	898	25	4	400	1	0	6	13.35	8.4	100	0.01420846	0.085251	19.166667	13	5.333333	2.45	0.166667	16.666667	6	6	6	0	0	50	50	0	3.5	6	0	0	0	0	0	16.6666667	66.666667	16.666667	0
2	01772/88	ZOKHUA	Grootgel	291	898	11	4	1156	1	0	6	9.65	7.0333333	100	0.01155956	0.069357	18.666667	12	4.333333	2.183333	0.666667	0	6	6	6	0	16.666667	50	33.333333	0	3.166667	6.166667	0	0	0	0	0	16.6666667	50	33.333333	0
2	01773/88	AUNGBAN	Grootgel	291	898	2	4	1849	1	0	6	13.76	7.58	83.333333	0.01632447	0.081622	20.8	11.2	5.2	3.5	0.4	20	6	5	5	0	0	100	0	0	3	5.2	0	0	0	0	0	20	40	40	0	0
2	01776/88	JOHNMEIKLECSO	Grootgel	291	898	28	6	289	9	0	6	12.9	9.4333333	100	0.01382281	0.082937	20.4	15	4.5	1.816667	0	0	6	6	6	16.66667	0	83.333333	0	0	2.666667	5.833333	0	0	0	0	0	16.6666667	83.333333	0	0
2	01778/88	ZAMBIACSO	Grootgel	291	898	16	6	841	9	0	6	12.366667	10.116667	100	0.01376427	0.082586	17.666667	16.5	5	1.433333	0.166667	0	6	6	6	0	0	66.666667	33.333333	0	3.333333	7.166667	0	0	0	0	0	0	0	0	83.333333	16.666667
2	01781/88	JINGDUNG(3)	Grootgel	291	898	16	4	841	1	0	6	10.95	7.3166667	100	0.01276	0.07656	17.2	10.3333333	4.666667	2.466667	0.666667	0	6	6	6	0	33.33333	66.666667	0	0	2.666667	5.5	0	0	0	0	33.333333	0	50	16.666667	0
2	01783/88	BODANA(A8)	Grootgel	291	898	27	6	324	9	0	6	13.666667	9.6666667	100	0.0162711	0.097627	18.833333	14.3333333	4.666667	2.066667	0.333333	0	6	6	6	0	0	100	0	0	3	6	0	0	0	0	0	16.6666667	66.666667	16.666667	0
2	01786/88	MORARANO	Grootgel	291	898	13	6	1024	9	0	6	13.45	10.3	100	0.01635307	0.098118	19.5	12.5	4.333333	2.066667	0.166667	0	6	6	6	0	0	100	0	0	3	6.666667	0	0	0	0	0	0	33.333333	66.666667	0
2	15133	CONTROL(15133)	Grootgel	291	898	26	6	361	9	0	6	14.033333	9.3333333	100	0.01615979	0.096959	22.5	19.6666667	4	2.3	0	0	6	6	6	0	16.666667	16.666667	66.666667	0	3.5	7.166667	0	0	0	0	0	16.666667	50	33.333333	0
2	23184	CONTROL(23184)	Grootgel	291	898	8	6	1369	9	0	6	9.8833333	8.8833333	100	0.00844577	0.050675	19.4	16.3333333	4.666667	1.25	0	16.666667	6	6	6	0	33.33333	50	16.666667	0	2.833333	6.833333	0	0	0	0	0	33.333333	50	16.666667	0
2	23493	CONTROL(23493)	Grootgel	291	898	7	6	1444	9	0	6	10.95	8.0666667	100	0.01071335	0.06428	18.4	16.6666667	3.166667	1.366667	0	0	6	6	6	16.66667	0	66.666667	16.666667	0	2.833333	7.166667	0	0	0	0	0	16.666667	50	33.333333	0
2	5/87	CONTROL(5/87)	Grootgel	291	898	9	6	1296	9	0	6	17.016667	12.233333	100	0.02293958	0.137638	22	15.3333333	3.333333	3.15	0	0	6	6	6	0	0	100	0	0	3	6.5	0	0	0	0	0	0	50	50	0
2	9	CONTROL(9)	Grootgel	291	898	10	6	1225	9	0	6	10.466667	8.0833333	100	0.00866721	0.052003	19.666667	12.8333333	3.166667	1.166667	0	33.333333	6	6	6	0	0	33.333333	66.666667	0	3.666667	6.666667	0	0	0	0	0	0	50	33.333333	16.666667
2	m2012	CONTROL(m2012)	Grootgel	291	898	11	6	1156	9	0	6	12.116667	10	100	0.01172063	0.070324	19	21.8333333	4.333333	2.183333	0	0	6	6	6	0	0	50	50	0

Plot Data Set - Grootgeluk

STEM9	BRATIO	FO_INDEX	INTNODE	CROWNPCT	FO_POS	TOP	VTREE	MFF	FLC	CCC	OC	LOTH	APHID	DG	HG	PILOCORR	VHA
0	0.132175	17.833333	0.658676	58.333333	1	0	0.08904	1	1	1	1	3	0	0	14.1705	11.41062	19.298524	154.59011
0	0.147961		0.740582	60		0	0.0787	1	1	1	1	2.16667	0	0	13.4729	10.89665	19.439707	136.62443
0	0.188539	48.25	0.762353	44	0.2	0	0.08805	1	1	1	1	1	0	0	14.9593	8.830629	18.99124	127.38678
0	0.195309	2.2142857	0.755614	45	4.2	0	0.08912	1	1	1	1	1.66667	0	0	15.077	9.982082	18.131466	154.72092
0	0.213955	35.516043	0.90862	56.666667	1.5333333	0	0.09294	1	1	1	1	2.16667	0	0	15.7988	9.200503	17.155534	161.3579
0	0.150441	6.2	0.681899	50	1.5	0	0.07351	1	1	1	1	1.66667	0	0	13.9936	9.422885	19.724905	127.62188
0	0.168224	42.5	0.740168	42	0.2	0	0.05783	1	1	1	1	2.6	0	0	12.1571	9.137372	18.273944	83.669679
0	0.169343	3.4490741	0.594443	41.666667	2.4333333	0	0.05929	1	1	1	1	3	0	0	13.0866	8.433123	18.805602	102.93457
0	0.199634	14.25	0.553725	45	0.4	0	0.0587	1	1	1	1	2.33333	0	0	13.2304	8.029777	17.179992	101.90344
0	0.172443	29.8	0.561461	48.333333	0.35	0	0.07401	1	1	1	1	2	0	0	14.4848	8.086488	18.331086	128.49518
0	0.352961	38	1.066667	63.333333	0.2333333	0	0.04552	1	1	1	1	3.33333	0	0	12.438	6.226366	19.006637	79.032659
0	0.253964	49.583333	0.600058	64	0.2333333	0	0.05444	1	1	1	1	3.4	0	0	12.1952	8.704898	20.63588	78.76654
0	0.278108	55.5	0.693102	56.666667	0.1333333	0	0.04854	1	1	1	1	2.5	0	0	11.6551	7.979149	18.208697	84.271129
0	0.346389	29	0.903	78	0.1666667	0	0.02502	1	1	1	1	2	0	0	8.66406	5.64693	16.700594	36.198408
0	0.345055	32.25	0.743056	65	0.15	0	0.02116	1	1	1	1	1.83333	0	0	8.45764	4.61322	17.395575	36.741694
0	0.289902	11	0.788889	51.666667	0.4	0	0.04483	1	1	1	1	3.83333	0	0	11.8083	6.962251	19.19659	77.825667
0	0.350883	52.333333	0.933333	60	0.1	0	0.0269	1	1	1	1	2	0	0	9.15742	5.553397	19.951404	46.703151
0	0.221499	25.611111	0.779659	53.333333	0.4	0	0.06344	1	1	1	1	4.16667	0	0	13.5379	8.21645	19.39621	110.13666
0	0.235146		0.699701	60		0	0.06478	1	1	1	1	2	0	0	13.4636	8.771567	18.747069	93.715781
0	0.22795	30.302681	0.715256	56.666667	2.92	0	0.07029	1	1	1	1	2.16667	0	0	13.8235	8.763617	17.182824	122.03805
0	0.167236	30.764619	0.670311	58.333333	1.725	0	0.07687	1	1	1	1	2.5	0	0	14.6425	9.191267	17.165835	133.44924
0	0.182395	6.2666667	0.765789	56.666667	1.5	0	0.08761	1	1	1	1	3.33333	0	0	14.9738	9.941403	17.141377	152.09822
0	0.197048	41.3125	0.722011	45	0.325	0	0.06695	1	1	1	1	2.16667	0	0	13.7012	8.493354	17.569955	116.22856
0	0.221641	48.85	0.546716	45	0.25	0	0.06328	1	1	1	1	3.5	0	0	13.5743	8.826778	20.68463	109.85293
0	0.236028	77.543478	0.744276	55	3.5	0	0.06102	1	1	1	1	3	0	0	13.5304	8.054554	19.64743	105.94165
0	0.175106	102	0.520483	46	0.1	0	0.06267	1	1	1	1	1	0	0	12.4789	9.876043	20.716958	90.66801
0	0.127902	2.1304348	0.518931	50	4.6	0	0.10205	1	1	1	1	3	0	0	16.7054	9.437512	19.656559	88.587353
0	0.197686		0.788106	60		0	0.06001	1	1	1	1	2.33333	0	0	12.8024	8.921041	18.500584	104.19248
0	0.172629	9.9226415	0.841049	51.666667	2.2666667	0	0.07855	1	1	1	1	3.16667	0	0	14.2994	9.44491	19.962359	136.37561
0	0.184974	42.154589	0.751693	63.333333	3.2	0	0.14309	1	1	1	1	2.66667	0	0	19.0308	10.56761	19.730178	124.21023
0	0.172005		0.486441	54		0	0.08067	1	1	1	1	1.8	0	0	14.5746	9.606739	22.245136	116.71283
0	0.158122	8.6309524	0.487488	44	1.35	0	0.05973	1	1	1	1	1.6	0	0	12.5258	8.837515	21.203864	86.41868
0	0.101964		0.522321	54		0	0.05751	1	1	1	1	1	0	0	12.5774	8.821985	20.615024	83.196074
0	0.189218		0.669931	51.666667		0	0.09634	1	1	1	1	1.83333	0	0	15.0212	10.91994	18.81229	167.25604
0	0.113478		0.549599	38		0	0.05661	1	1	1	1	1	0	0	12.6467	8.583398	19.003132	81.898796
0	0.170244	22.479167	0.505966	58.333333	1.75	0	0.09136	1	1	1	1	3.5	0	0	13.8539	12.06629	19.795692	158.60829
0	0.188122	8.5794872	0.715285	55	2.05	0	0.07719	1	1	1	1	2.16667	0	0	13.8789	10.08918	19.407145	134.00658
0	0.147402	2.8372093	0.657245	51.666667	4.3	0	0.06911	1	1	1	1	2.5	0	0	12.7325	10.50833	19.004831	119.99019
0	0.167766		0.793693	51.666667		0	0.06342	1	1	1	1	1.83333	0	0	12.4742	9.942749	18.199812	110.09822
0	0.14582	12.857143	0.773841	50	0.7	0	0.08048	1	1	1	1	1.66667	0	0	14.085	10.15461	17.928381	139.71782
0	0.157729	13.142857	0.872476	53.333333	0.7	0	0.0757	1	1	1	1	1.66667	0	0	13.7682	10.17573	17.13752	131.42973
0	0.163595		0.85537	56.666667		0	0.09057	1	1	1	1	2.16667	0	0	14.8896	10.42395	18.978957	157.24504
0	0.198238	53.5	0.618782	50	0.15	0	0.05833	1	1	1	1	2.66667	0	0	13.3023	7.877758	17.218217	101.26268
0	0.163307	11.669643	0.631485	43.333333	0.75	0	0.08143	1	1	1	1	3.33333	0	0	14.9376	9.122015	19.825423	141.37182
0	0.181411	38.25	0.588358	41.666667	0.2	0	0.05239	1	1	1	1	1.66667	0	0	12.3945	7.990968	17.976907	90.957586
0	0.160282	17.8	0.612609	51.666667	0.5	0	0.0639	1	1	1	1	1.83333	0	0	13.2413	8.798178	20.316928	110.93571
0	0.268773	43.083333	1.233889	70	0.1833333	0	0.05217	1	1	1	1	2	0	0	12.3369	7.403788	20.795058	90.574048
0	0.233127	87	0.658501	68	0.1	0	0.08465	1	1	1	1	3.4	0	0	14.9927	9.803719	21.569154	122.46814
0	0.22063	53.5	0.791524	66.666667	0.2	0	0.03773	1	1	1	1	3	0	0	10.2903	7.590597	18.878352	65.500615
0	0.373059	8.8	0.968056	75	0.5	0	0.01818	1	1	1	1	1.83333	0	0	7.21815	5.154565	18.372923	31.566889
0	0.344072	25.7	1.138667	70	0.6	0	0.0354	1	1	1	1	1.8	0	0	10.2213	6.76829	18.535147	51.221271
0	0.240812		0.671381	58		0	0.0199	1	1	1	1	2.8	0	0	8.18499	4.889233	12.96314	28.794548
0	0.305039	59.5	1.058611	78.333333	0.1	0	0.03073	1	1	1	1	1.83333	0	0	10.2434	5.720055	19.436241	53.353109
0	0.182596	34.848309	0.71931	50	2.5	0	0.06069	1	1	1	1	2.83333	0	0	13.0761	8.397518	17.705475	105.36816
0	0.185968	2.7037037	0.663448	51.666667	2.7	0	0.053	1	1	1	1	2	0	0	12.2296	8.507359	17.538809	92.011535
0	0.185207	30.579226	0.651122	51.666667	1.8333333	0	0.07321	1	1	1	1	2.5	0	0	14.5353	8.356459	19.600711	127.10188
0	0.163139	38.431638	0.656583	41.666667	1.34	0	0.0712	1	1	1	1	2.83333	0	0	13.8985	8.250314	17.783341	123.61395
0	0.201649	3.4242424	0.838294	52	3.3	0	0.09957	1	1	1	1	2.8	0	0	15.7251	10.37088	17.16189	144.05506
0	0.184432	2.4285714	0.617153	48.333333	3.5	0	0.06195	1	1	1	1	2	0	0	13.4475	8.403988	19.107789	107.55433
0	0.221208	21.413889	0.567902	51.666667	0.575	0	0.05082	1	1	1	1	2	0	0	12.1294	7.912225	18.922084	88.233128
0	0.257898	17.342593	0.633889	52	1.45	0	0.06599	1	1	1	1	2.6	0	0	14.4141	7.785427	20.706296	95.471259
0	0.14656		0.594224	51.666667		0	0.07008	1	1	1	1	2.16667	0	0	13.2637	9.739957	20.263823	121.66622
0	0.119431	101	0.593082	46.666667	0.1	0	0.07347	1	1	1	1	2.66667	0	0	13.2356	10.41973	17.691318	127.54577
0	0.227874	12.975291	0.677684	46.666667	1.9	0	0.05368	1	1	1	1	2.83333	0	0	12.7436	7.720085	17.262593	93.192864
0	0.15572	6.7083333	0.664615	51.666667	1.6	0	0.08101	1	1	1	1	3.16667	0	0	14.3905	9.825281	18.747557	140.63895
0	0.153504	9.1818182	0.841298	50	1.1	0	0.08537	1	1	1	1	3.16667	0	0	14.4267	10.37615	19.432628	148.21543
0	0.168363		0.451064	66.666667		0	0.07897	1	1	1	1	2.16667	0	0	14.3412	9.533173	22.383077	137.09261
0	0.13176		0.534183	53.333333		0	0.04441	1	1	1	1	1.16667	0	0	10.3678	9.284323	19.569623	77.097836
0	0.1648		0.470107	58.333333		0	0.05166	1	1	1	1	1	0	0	11.677	8.731473	18.401433	89.692583
0	0.188884		0.798569	65		0	0.13596	1	1	1	1	1	0	0	17.0868	12.24119	21.62966	236.04635
0	0.111643		0.617362	48.333333		0	0.03934	1	1	1	1	1	0	0	10.5029	8.094947	19.852712	68.300052
0	0.181887		0.436336	56.666667		0	0.06099	1	1	1	1	2.83333	0	0	12.2136	10.01106	19.045887	105.89315
0	0.124282	60.855072	0.774761	48.333333	1.85	0	0.11453	1	1	1	1	2.66667	0	0	16.8428	9.20349	19.542665	198.83851
0	0.146747	80.75	0.848386	45	0.15	0	0.09698	1	1	1	1	3	0	0	14.7327	11.19376	20.002663	168.37135

Plot Data Set - Grootgeluk

BLOCK	SEEDLOT	PROVNAME	SITE	DATEESS	DATEASS	PLOTX	PLOTY	_TYPE	_FREQ	DBH	HIGHT	SURV	GMEAN	GSUM	MEANPLOT	WHORAN	BRANCH	DIABAR	FORK	FOXTAIL	NO_TOTAL	NO_NOG	NOHIGHT	KRAFT1	KRAFT2	KRAFT3	KRAFT4	KRAFT5	KRAFTT	KRASTM	STEM1	STEM2	STEM3	STEM4	STEM5	STEM6	STEM7	STEM8
3	01515/85	DATHIEN	Grootgel	291	898	42	1	9	4	0	6	15.2	10.683333	100	0.01838126	0.110288	18.666667	13.6666667	5.166667	2.4	0.5	0	6	6	6	0	0	50	50	0	3.5	6.166667	0	0	0	0	16.6666667	50	33.333333	0
3	01516/85	XUANTHO	Grootgel	291	898	32	1	169	4	0	6	12.683333	10.116667	100	0.01815079	0.108905	18.333333	12.3333333	4.666667	1.733333	0.833333	0	6	6	6	0	0	66.666667	33.333333	0	3.333333	6.166667	0	0	0	0	16.6666667	50	33.333333	0
3	01517/85	HOTHIEN	Grootgel	291	898	31	1	196	4	0	6	14.65	10.016667	100	0.01933682	0.116021	19.333333	11.5	4.666667	2.4	0.333333	0	6	6	6	0	0	100	0	0	3	5.833333	0	0	0	0	16.6666667	83.333333	0	0
3	01518/85	THACPRENN	Grootgel	291	898	33	1	144	4	0	6	14.533333	9.9833333	100	0.01989324	0.119359	19	10.5	4.5	2.166667	0.5	0	6	6	6	0	0	83.333333	16.666667	0	3.166667	7.166667	0	0	0	0	0	0	16.666667	50	33.333333
3	01521/85	NONGKRATING	Grootgel	291	898	48	3	9	0	0	6	13.866667	8.35	100	0.01678417	0.100705	18.166667	13.5	5.833333	2.233333	0.5	0	6	6	6	0	0	50	33.333333	16.666667	3.666667	5.166667	0	0	0	0	16.666667	50	33.333333	0	0
3	01522/85	DOISUTHEP	Grootgel	291	898	56	3	121	0	0	6	13.6	8.4833333	100	0.01510405	0.090624	16.666667	12.1666667	4.833333	2.4	0.5	33.333333	6	6	6	0	33.333333	50	16.666667	0	2.833333	5.666667	0	0	0	0	16.666667	0	83.333333	0	0
3	01524/85	PHUKRADUNG	Grootgel	291	898	52	3	49	0	0	6	12.616667	8.15	100	0.01267763	0.076066	15.5	9.6666667	5.166667	2.55	0.166667	33.333333	6	6	6	0	0	83.333333	16.666667	0	3.166667	5.833333	0	0	0	0	0	16.6666667	83.333333	0	0
3	01525/85	NAMNOW	Grootgel	291	898	50	3	25	0	0	6	12.333333	8.0333333	100	0.01217648	0.073059	16.166667	13.5	4.833333	2.05	0	50	6	6	6	0	16.666667	50	33.333333	0	3.166667	5.166667	0	0	0	0	33.333333	16.6666667	50	0	0
3	01623/86	SHANGBAI	Grootgel	291	898	38	2	49	1	0	6	10.166667	6.3	100	0.0112052	0.067231	18.833333	5.16666667	4.5	3.75	0.833333	16.666667	6	6	6	0	33.333333	33.333333	33.333333	0	3	5.5	0	0	0	0	16.666667	16.6666667	66.666667	0	0
3	01625/86	BAOSHAN(2)	Grootgel	291	898	42	2	9	1	0	6	14.4	9.975	66.666667	0.02709732	0.108389	19.5	12.5	3.75	3.175	1	0	6	4	4	0	0	75	25	0	3.25	5.75	0	0	0	0	25	0	50	25	0
3	01626/86	MAGUAN	Grootgel	291	898	36	2	81	1	0	6	9.6666667	5.9	100	0.01204055	0.072243	20	9.5	3.666667	2.85	0.666667	0	6	6	6	0	16.666667	50	33.333333	0	3.166667	3.833333	0	33.333333	0	33.333333	16.6666667	16.666667	0	0
3	01628/86	HUIZE	Grootgel	291	898	39	2	36	1	0	6	7.72	5.14	83.333333	0.00825817	0.041291	20.8	4.4	4.4	1.76	0.8	20	6	5	5	0	40	40	20	0	2.8	4.2	0	40	0	0	20	40	0	0
3	01629/86	LANPING	Grootgel	291	898	41	2	16	1	0	6	7.9166667	5.55	100	0.00698146	0.041889	19.8	5.16666667	4.833333	2.65	1.166667	33.333333	6	6	6	16.66667	33.333333	33.333333	16.666667	0	2.5	4.333333	0	16.666667	0	0	50	0	33.333333	0	0
3	01633/86	SHANGSI	Grootgel	291	898	40	2	25	1	0	6	10.14	5.78	83.333333	0.01262627	0.063131	20.4	6	3.4	2.92	0.8	0	6	5	5	0	20	40	40	0	3.2	4.4	0	20	0	0	40	0	40	0	0
3	01634/86	DUKOU	Grootgel	291	898	37	2	64	1	0	6	8	5.04	83.333333	0.0063371	0.031686	19.5	4.8	3.8	2.22	0.6	20	6	5	5	0	40	60	0	0	2.6	5	20	0	0	0	20	40	20	0
3	01635/86	JINDUNG(1)	Grootgel	291	898	35	2	100	1	0	6	12.48	8.18	83.333333	0.0157938	0.078969	19.4	11.8	4.4	3.46	0.4	20	6	5	5	0	0	40	40	20	3.8	5.6	0	0	0	0	20	0	80	0	0
3	01637/86	JINGHONG	Grootgel	291	898	32	2	169	1	0	6	14.75	9.15	100	0.01723661	0.10342	19	12.8333333	5.833333	2.766667	0.166667	0	6	6	6	0	0	16.666667	83.333333	0	3.833333	6.166667	0	0	0	0	0	0	83.333333	16.666667	0
3	01638/86	LANCANG	Grootgel	291	898	34	2	121	1	0	6	15.42	8.66	83.333333	0.01908076	0.095404	18.4	13.2	4	2.8	0.2	20	6	5	5	0	0	40	60	0	3.6	5.6	0	0	0	0	40	60	0	0
3	01639/86	SIMAO	Grootgel	291	898	31	2	196	1	0	6	12.916667	8.9333333	100	0.01449865	0.086992	17.666667	13.1666667	4.5	2.116667	0.5	0	6	6	6	0	0	16.666667	83.333333	0	3.833333	5.666667	0	0	0	0	16.666667	0	83.333333	0	0
3	01680/86	DAKHA	Grootgel	291	898	57	1	144	4	0	6	15.64	10.5	83.333333	0.01944077	0.097204	16.6	13.6	4.8	2.68	0	0	6	5	5	0	0	60	40	0	3.4	5.4	0	0	0	0	40	0	40	20	0
3	01766/88	WATCHAN	Grootgel	291	898	53	3	64	0	0	6	13.466667	8.15	100	0.01686798	0.101208	16.333333	11.8333333	4.833333	2.483333	1	16.666667	6	6	6	0	83.333333	16.666667	0	3.166667	5.666667	0	0	0	0	0	33.3333333	66.666667	0	0
3	01772/88	ZOKHUA	Grootgel	291	898	38	3	49	0	0	6	11.72	7.98	83.333333	0.01792324	0.089616	18.8	14	4.2	2.52	0.8	0	6	5	5	0	0	40	60	0	3.6	4.8	0	0	20	20	20	40	0	0
3	01773/88	AUNGBAN	Grootgel	291	898	33	3	144	0	0	6	11.84	7.52	83.333333	0.01654824	0.082741	18.2	10.8	4.2	2.78	0.6	0	6	5	5	0	0	20	80	0	3.8	5.8	0	0	0	0	20	80	0	0
3	01776/88	JOHNMEIKLECSO	Grootgel	291	898	60	2	225	1	0	6	13.44	10.5	83.333333	0.01487577	0.074379	20	18.2	4	1.88	0.4	0	6	5	5	0	0	80	20	0	3.2	5.8	0	0	0	0	20	80	0	0
3	01778/88	ZAMBIACSO	Grootgel	291	898	49	2	16	1	0	6	14.666667	10.3	100	0.01733155	0.103989	18.333333	14.8333333	4.5	2.233333	0.166667	16.666667	6	6	6	0	0	66.666667	33.333333	0	3.333333	7	0	0	0	0	0	0	0	100	0
3	01781/88	JINGDUNG(3)	Grootgel	291	898	33	2	144	1	0	6	12.55	8.45	100	0.0125252	0.075151	19.166667	12.3333333	4.333333	2.883333	0.333333	0	6	6	6	0	0	50	50	0	3.5	5.5	0	0	0	0	16.666667	16.666667	66.666667	0	0
3	01783/88	BODANA(A8)	Grootgel	291	898	60	1	225	4	0	6	14.25	9.5666667	100	0.01600539	0.096032	17.166667	14	5.333333	2.75	0	16.666667	6	6	6	0	0	33.333333	66.666667	0	3.666667	6	0	0	0	0	0	33.3333333	33.333333	33.333333	0
3	01786/88	MORARANO	Grootgel	291	898	45	2	0	1	0	6	15.016667	10.283333	100	0.01915139	0.114908	18.5	14.3333333	4.333333	2.516667	0.333333	0	6	6	6	0	0	50	50	0	3.5	5.8	0	0	0	0	0	20	80	0	0
3	15133	CONTROL(15133)	Grootgel	291	898	50	1	25	4	0	6	13.866667	9.8833333	100	0.01532536	0.091952	21.166667	18.5	3.666667	2.25	0	0	6	6	6	0	0	33.333333	66.666667	0	3.666667	7.333333	0	0	0	0	0	0	0	66.666667	33.333333
3	23184	CONTROL(23184)	Grootgel	291	898	48	1	9	4	0	6	11	9.8666667	100	0.01007626	0.060458	18.8	14.1666667	5.333333	1.45	0.333333	16.666667	6	6	6	0	33.333333	50	16.666667	0	2.833333	6.5	0	0	0	0	0	0	50	50	0
3	23493	CONTROL(23493)	Grootgel	291	898	45	1	0	4	0	6	11.7	8.95	100	0.01087376	0.065243	19.333333	13.1666667	4.333333	1.266667	0	0	6	6	6	0	16.666667	83.333333	0	0	2.833333	7.166667	0	0	0	0	0	0	83.333333	16.666667	0
3	5/87	CONTROL(5/87)	Grootgel	291	898	49	1	16	4	0	6	15.566667	10.5	100	0.01941081	0.116465	22.166667	14.5	3.833333	2.666667	0	0	6	6	6	0	0	33.333333	66.666667	0	3.666667	5.833333	0	0	0	0	16.666667	0	66.666667	16.666667	0
3	9	CONTROL(9)	Grootgel	291	898	46	1	1	4	0	6	13.883333	9.2833333	100	0.01560415	0.093625	17.833333	11.6666667	4	1.233333	0	33.333333	6	6	6	0	0	50	50	0	3.5	7.5	0	0	0	0	0	0	0	50	50
3	m2012	CONTROL(m2012)	Grootgel	291	898	47	1	4	4	0	6	14.816667	10.866667	100	0.01761532	0.105692	18	22.5	5.333333	3.483333	0	0	6	6	6	0	0	50	33.333333	16.666667	3.666667	7	0	0	0	0	0	0	16.666667	66.666667	16.666667
4	01447/84	MT.PROVINCE	Grootgel	291	898	45	5	0	4	0	6	12.583333	9.4	100	0.01317054	0.079023	19.333333	14.6666667	4.833333	2.066667	0.166667	0	6	6	6	0	16.666667	50	33.333333	0	3.166667	6	0	0	0	0	16.666667	66.666667	16.666667	0
4	01506/85	TARLAC	Grootgel	291	898	46	5	1	4	0	6	14	10.016667	100	0.01749825	0.10499	22	14.5	4.833333	2.85	0.166667	0	6	6	6	0	0	50	33.333333	16.666667	3.666667	5.5	0	0	0	0	0	50	50	0	0
4	01515/85	DATHIEN	Grootgel	291	898	35	4	100	1	0	6	12.916667	10.05	100	0.0147747	0.088648	18.833333	13.6666667	4.5	2.35	0.333333	16.666667	6	6	6	0	16.666667	50	33.333333	0	3.166667	5.666667	0	0	0	0	33.333333	0	33.333333	33.333333	0
4	01516/85	XUANTHO	Grootgel	291	898	31	4	196	1	0	6	13.84	9.1	83.333333	0.01884991	0.09425	19.2	15	4.4	1.96	0.6	0	6	5	5	0	20	40	40	0	3.2	5.8	0	0	0	0	0	40	40	20	0
4	01517/85	HOTHIEN	Grootgel	291	898	38	4	49	1	0	6	13.68	9.64	83.333333	0.01510771	0.075539	18.2	12.8	5.6	2.3	0.2	60	6	5	5	0	0	60	40	0	3.4	6.2	0	0	0	0	0	0	80	20	0
4	01518/85	THACPRENN	Grootgel	291	898	32	4	169	1	0	6	15.316667	10.533333	100	0.01850868	0.111052	17.166667	12	5.333333	2.5	0.333333	16.666667	6	6	6	0	0	100	0	0	3	6.666667	0	0	0	0	0	0	33.333333	66.666667	0
4	01521/85	NONGKRATING	Grootgel	291	898	53	4	64	1	0	6	10.316667	7.0833333	100	0.0116858	0.070115	17	12.3333333	4.333333	1.816667	0.5	0	6	6	6	0	33.333333	33.333333	33.333333	0	3	5.5	0	0	0	0	16.666667	16.666667	66.666667	0	0
4	01522/85	DOISUTHEP	Grootgel	291	898	60	4	225	1	0	6	14.75	9.05	83.333333	0.01726607	0.069064	18.25	14.25	6.25	2.25	0	0	6	4	4	0	0	50	50	0	3.5	5.25	0	0	0	0	25	25	50	0	0
4	01524/85	PHUKRADUNG	Grootgel	291	898	56	5	121	4	0	6	12.716667	7.3166667	100	0.01282089	0.076925	18.833333	11.1666667	4.666667	2.666667	0.166667	0	6	6	6	0	0	66.666667	33.333333	0	3.333333	5	0	0	0	0	16.666667	66.666667	16.666667	0	0
4	01525/85	NAMNOW	Grootgel	291	898	56	4	121	1	0	6	12.566667	8.0833333	100	0.01304888	0.078293	20	13.8333333	6.166667	1.833333	0.166667	33.333333	6	6	6	0	16.666667	50	33.333333	0	3.166667	5.333333	0	0	0	0	16.666667	50	16.666667	16.666667	0
4	01623/86	SHANGBAI	Grootgel	291	898	51	5	36	4	0	6	9.1333333	5.5666667	100	0.00888381	0.053303	19.833333	6.33333333	3.666667	2.9	0.5	16.666667	6	6	6	0	33.333333	66.666667	0	0	2.666667	5	0	0	0	0	16.666667	66.666667	16.666667	0	0
4	01625/86	BAOSHAN(2)	Grootgel	291	898	49	5	16	4	0	6	9.3833333	6.8166667	100	0.01321414	0.079285	19.6	8.66666667	3.833333	2.816667	0.666667	0	6	6	6	0	33.333333	50	16.666667	0	2.833333	4	0	33.333333	0	0	16.666667	33.3333333	16.666667	0	0
4	01626/86	MAGUAN	Grootgel	291	898	50	5	25	4	0	6	10.383333	6.7333333	100	0.01127749	0.067665	18.5	11.5	5.166667	2.216667	0.333333	16.666667	6	6	6	0	16.666667	50	16.666667	16.666667	3.333333	4.833333	0	0	0	16.666667	16.666667	33.3333333	33.333333	0	0
4	01628/86	HUIZE	Grootgel	291	898	47	5	4	4	0	6	5.14	3.75	83.333333	0.00242016	0.012101	17.5	4.4	4.6	1.72	0.4	20	6	5	4	40	20	40	0	0	2	3.6	0	20	40	0	40	0	0	0	0
4	01629/86	LANPING	Grootgel	291	898	53	5	64	4	0	6	8.1	5.6	100	0.00637254	0.038235	20.6	5	5.166667	2.533333	0.5	16.666667	6	6	6	0	33.333333	33.333333	16.666667	16.666667	3.166667	4.666667	0	16.666667	16.666667	0	16.666667	0	50	0	0
4	01633/86	SHANGSI	Grootgel	291	898	48	5	9	4	0	6	6.4666667	3.9833333	100	0.0033846	0.020306	19.333333	6.66666667	4.833333	1.983333	0	16.666667	6	6	6	0	100	0	0	0	2	2.666667	0	33.333333	66.666667	0	0	0	0	0	0
4	01634/86	DUKOU	Grootgel	291	898	52	5	49	4	0	6	7.9666667	5.32	100	0.00606689	0.036401	20.8	4.8	5.8	2.64	0.6	0	6	6	5	0	0	100	0	0	3	5.4	0	0	0	20	0	20	40	20	0
4	01635/86	JINDUNG(1)	Grootgel	291	898	56	6	121	9	0	6	10.816667	6.45	100	0.01021677	0.061301	17.2	12.1666667	3.833333	2.75	0.333333	0	6	6	6	0	33.333333	50	16.666667	0	2.833333	4.833333	0	0	0	16.666667	33.333333	16.666667	16.666667	16.666667	0
4	01637/86	JINGHONG	Grootgel	291	898	58	6	169	9	0	6	10.7	7.62	83.333333	0.01163439	0.058172	17.6	12.4	4.2	2.42	0.4	0	6	5	5	0	0	60	40	0	3.4	5.6	0	0	0	0	0	40	60	0	0
4	01638/86	LANCANG	Grootgel	291	898	57	6	144	9	0	6	10.833333	7.15	100	0.01409192	0.084552	17.833333	12.3333333	4.666667	2.083333	0.666667	0	6	6	6	0	16.666667	33.333333	33.333333	16.666667	3.5	5.833333	0	0	0	0	16.666667	83.333333	0	0	0
4	01639/86	SIMAO	Grootgel	291	898	59	6	196	9	0	6	12.5	8.6833333	100	0.01579482	0.094769	19	12	5.166667	2.733333	0.833333	0	6	6	6	0	16.666667	50	16.666667	16.666667	3.333333	5.666667	0	0	0	0	0	50	33.333333	16.666667	0
4	01680/86	DAKHA	Grootgel	291	898	47	4	4	1	0	6	14.3	9.5	100	0.01643217	0.098593	17.5	13.8333333	4	2.416667	0.166667	33.333333	6	6	6	0	0	66.666667	33.333333	0	3.333333	6.166667	0	0	0	0	0	16.666667	50	33.333333	0	0
4	01766/88	WATCHAN	Grootgel	291	898	58	4	169	1	0	6	14.24	8.72	83.333333	0.01810349	0.090517	16.8	12.2	6	2.2	0.8	0	6	5	5	0	0	40	60	0	3.6	5.6	0	0	0	0	0	40	60	0	0
4	01772/88	ZOKHUA	Grootgel	291	898	45	6	0	9	0	6	10.766667	6.15	100	0.01253005	0.07518	19.8	12.3333333	2.833333	1.9	0.833333	0	6	6	6	16.666667	16.666667	0	66.666667	0	3.166667	4.166667	0	16.666667	33.333333	0	16.666667	33.333333	0	0	0
4	01773/88	AUNGBAN	Grootgel	291	898	50	6	25	9	0	6	14.42	8.4	83.333333	0.01871131	0.093557	19	12	5.4	2.94	0.8	0	6	5	5	0	0	20	40	40	4.2	5.6	0	0	0	0	0	40	60	0	0
4	01776/88	JOHNMEIKLECSO	Grootgel	291	898	37	6	64	9	0	6	13.583333	10.75	100	0.01480639	0.088838	20.5	19.8333333	4.333333	1.683333	0	0	6	6	6	0	33.333333	50	16.666667	0	2.833333	6.166667	0	0	0	0	0	0	83.333333	16.666667	0
4	01778/88	ZAMBIACSO	Grootgel	291	898	36	6	81	9	0	6	14.1	10.783333	100	0.01580281	0.094817	17.833333	17.3333333	4.333333	2	0.166667	16.666667	6	6	6	0	0	83.333333	16.666667	0	3.166667	6.833333	0	0	0	0	0	0	33.333333	50	16.666667	0
4	01781/88	JINGDUNG(3)	Grootgel	291	898	60	6	225	9	0	6	11.783333	8.55	100	0.01344423	0.080665	18.333333	10	4.666667	2.733333	1	50	6	6	6	0	16.666667	66.666667	16.666667	0	3	5.5	0	0	0	0	0	50	50	0	0
4	01783/88	BODANA(A8)	Grootgel	291	898	38	6	49	9	0	6	14.066667	10.166667	100	0.0181356	0.108814	18.666667	15	5.166667	1.816667	0.166667	0	6	6	6	0	16.666667	33.333333	50	0	3.333333	6.5	0	0	0	0	0	0	50	50	0
4	01786/88	MORARANO	Grootgel	291	898	38	5	49	4	0	6	13.2	10.1	83.333333	0.01409226	0.070461	19.8	10.8	4.2	2.9	0.2	0	6	5	5	0	0	100	0	0	3	6.4	0	0	0	0	0	20	20	60	0
4	15133	CONTROL(15133)	Grootgel	291	898	40	5	25	4	0	6	13.533333	10.183333	100	0.01455274	0.087316	21.833333	18.8333333	3.833333	2.266667	0	0	6	6	6	0	16.666667	66.666667	16.666667	0	3.666667	6.666667	0	0	0	0	0	0	33.333333	66.666667	0
4	23184	CONTROL(23184)	Grootgel	291	898	43	5	4	4	0	6	12.3	9.7	83.333333	0.0121341	0.060671	19	14.6	4.6	1.78	0.2	0	6	5	5	0	20	40	40	0	3.2	6.2	0	0	0	0	0	0	80	20	0
4	23493	CONTROL(23493)	Grootgel	291	898	39	5	36	4	0	6	10.566667	8.6166667	100	0.00941679	0.056501	18.8	16	3.666667	1.116667	0	0	6	6	6	16.666667	50	33.333333	0	0	2.166667	7	0	0	0	0	0	0	16.666667	66.666667	16.666667
4	5/87	CONTROL(5/87)	Grootgel	291	898	42	5	9	4	0	6	17.183333	12.65	100	0.02344873	0.140692	20.666667	14.6666667	4.333333	4.333333	0.5	0	6	6	6	0	0	50	0	50	4	6	0	0	0	0	0	16.6666667	66.666667	16.666667	0
4	9	CONTROL(9)	Grootgel	291	898	44	5	1	4	0	6	14.18	9.9	83.333333	0.0161249	0.080625	17.8	16	3.4	1.28	0	0	6	5	5	0	20	80	0	0	2.8	7.2	0	0	0	0	0	0	0	80	20
4	m2012	CONTROL(m2012)	Grootgel	291	898	41	5	16	4	0	6	14.366667	12.366667	100	0.01685226	0.101114	17.833333	23	3.833333	2	0	0	6	6	6	0	16.666667	50	33.333333	0	3.166667	6.833333	0	0	0	0	0	0	33.333333	50	16.666667
5	01447/84	MT.PROVINCE	Grootgel	291	898	74	3	841	0	0	6	10.133333	8.2666667	100	0.00933298	0.055998	21.2	12.6666667	3.833333	1.716667	0.166667	16.666667	6	6	6	16.666667	33.333333	50	0	0	2.333333	4.666667	0	0	0	0	33.333333	66.666667	0	0	0
5	01506/85	TARLAC	Grootgel	291	898	75	3	900	0	0	6	12.033333	9.75	100	0.01289842	0.077391	21.333333	13	5.333333	1.566667	0.166667	0	6	6	6	0	33.333333	50	16.666667	0	2.833333	5.333333	0	0	0	0	33.333333	16.6666667	33.333333	16.666667	0
5	01515/85	D

Plot Data Set - Grootgeluk

STEM9	BRATIO	FO_INDEX	INTNODE	CROWNPCT	FO_POS	TOP	VTREE	MF	FF	CL	CC	OC	LOTH	APID	DG	HG	PILOCORR	VHA
0	0.159143	13.68	0.759199	51.666667	2.5	0	0.09729	1	1	1	1	2.33333	0	0	15.2952	10.69257	18.450642	168.90332
0	0.139506	67.948352	0.808164	45	1.92	0	0.09894	1	1	1	1	2	0	0	15.199	10.65217	18.331086	171.76216
0	0.162077	44.05	0.853405	56.666667	1.05	0	0.09684	1	1	1	1	1.83333	0	0	15.6877	10.45911	19.164028	168.12594
0	0.147584	50.890625	0.934839	46.666667	1.7	0	0.10144	1	1	1	1	2	0	0	15.9118	10.27824	18.840605	176.10393
0	0.159965	20.826087	0.591881	48.333333	1.35	0	0.07234	1	1	1	1	2.5	0	0	14.6156	8.564355	18.063902	125.59689
0	0.18201	4.9309091	0.661125	45	2.35	0	0.0675	1	1	1	1	2.16667	0	0	13.8648	8.612989	16.586553	117.18232
0	0.199028	3.75	0.808243	51.666667	2	0	0.05521	1	1	1	1	1.5	0	0	12.7024	8.216221	15.503415	95.858686
0	0.169539		0.580073	50		0	0.052	1	1	1	1	1.83333	0	0	12.4488	8.039108	16.19415	90.273827
0	0.359647	42.357143	1.123333	73.333333	0.825	0	0.04411	1	1	1	1	2.16667	0	0	11.942	6.87806	19.044862	76.574898
0	0.222052	95	0.798849	55	0.1333333	0	0.13859	1	1	1	1	3.75	0	0	18.5708	11.04007	19.351931	160.40125
0	0.380012	45.93	0.6125	58.333333	1.35	0	0.05399	1	1	1	1	3	0	0	12.3791	7.441242	20.127151	93.728906
0	0.226288	42.666667	1.038	74	0.1666667	0	0.03527	1	1	1	1	1.2	0	0	10.252	5.457539	21.21936	51.02071
0	0.347801	36.85	1.004286	75	0.62	0	0.03251	1	1	1	1	1.83333	0	0	9.42629	6.389196	20.137813	56.442752
0	0.292985	50.333333	0.883357	66	0.1666667	0	0.04745	1	1	1	1	3.2	0	0	12.6767	6.971196	20.613794	68.648271
0	0.269901	4.1610577	0.910333	72	2.25	0	0.02612	1	1	1	1	2	0	0	8.98076	5.884664	19.789395	37.79606
0	0.287742	60	0.677986	54	0.15	0	0.06987	1	1	1	1	3.8	0	0	14.1779	8.444534	19.415024	101.08681
0	0.188119	3.8333333	0.690143	50	2.4	0	0.07979	1	1	1	1	3	0	0	14.8113	9.173658	18.822201	138.53066
0	0.189175	5.3529412	0.626013	58	1.7	0	0.08183	1	1	1	1	2.8	0	0	15.5835	8.607684	18.165288	118.38899
0	0.166037	28.651515	0.646844	51.666667	1.5333333	0	0.06901	1	1	1	1	3.16667	0	0	13.5841	9.075711	17.644599	119.80248
0	0.168172		0.773189	54		0	0.09994	1	1	1	1	2.2	0	0	15.7298	10.45724	16.3466	144.59547
0	0.184789	54.49	0.66516	51.666667	2.15	0	0.0739	1	1	1	1	1.66667	0	0	14.6521	8.075932	16.264546	128.3024
0	0.216597	69.625	0.555444	54	0.125	0	0.07999	1	1	1	1	3	0	0	15.1034	8.088918	18.879582	115.72847
0	0.23843	57.666667	0.688333	58	0.1333333	0	0.07094	1	1	1	1	3.2	0	0	14.5125	8.174761	18.269389	102.63819
0	0.140836	13.08	0.55173	52	2.75	0	0.08154	1	1	1	1	1.4	0	0	13.7597	10.75612	19.933478	117.9707
0	0.155843	2.254902	0.730506	53.333333	5.1	0	0.08977	1	1	1	1	2	0	0	14.852	10.36057	18.162613	155.84456
0	0.227136	1.4241784	0.659392	48.333333	6.55	0	0.05563	1	1	1	1	4.66667	0	0	12.6258	8.4481	19.175745	96.58821
0	0.191676		0.665581	56.666667		0	0.07748	1	1	1	1	2.5	0	0	14.2725	9.57753	17.031339	134.5221
0	0.169272	24.835106	0.710651	56.666667	2.45	0	0.09877	1	1	1	1	2.83333	0	0	15.6123	10.51566	18.299549	171.48396
0	0.165016		0.520903	51.666667		0	0.07711	1	1	1	1	1.66667	0	0	13.966	9.923614	21.063902	133.86804
0	0.136075	4.7555556	0.742046	53.333333	1.65	0	0.05568	1	1	1	1	1.33333	0	0	11.3245	10.25636	18.845604	96.674032
0	0.109249		0.651789	50		0	0.05207	1	1	1	1	1	0	0	11.7641	8.981812	19.414614	90.39839
0	0.176556		0.712505	58.333333		0	0.09763	1	1	1	1	1.33333	0	0	15.7177	10.33157	21.919496	169.49395
0	0.091737		0.781002	50		0	0.07503	1	1	1	1	1	0	0	14.0925	9.390559	17.729152	130.26145
0	0.246173		0.465638	53.333333		0	0.09656	1	1	1	1	4.5	0	0	14.9731	10.97021	17.816538	167.64636
0	0.173895	2.6052632	0.605941	55	3.8	0	0.06676	1	1	1	1	2	0	0	12.947	9.702346	19.33958	115.89697
0	0.20342	18.2	0.665383	61.666667	0.5	0	0.08822	1	1	1	1	2.66667	0	0	14.9233	10.16567	21.885909	153.15544
0	0.184679	100	0.713522	51.666667	0.2	0	0.07795	1	1	1	1	1.83333	0	0	13.7128	10.36057	18.811265	135.33511
0	0.140719	72.75	0.577822	52	0.2	0	0.09054	1	1	1	1	1	0	0	15.489	9.382557	19.0995	130.98814
0	0.173068	1.1351351	0.83297	56	7.4	0	0.0753	1	1	1	1	1.4	0	0	13.8665	9.746655	18.113091	108.94639
0	0.16245	2.1764706	0.945556	56.666667	5.1	0	0.09707	1	1	1	1	1.83333	0	0	15.3481	10.56506	16.940732	168.52904
0	0.176435	15.185185	0.534713	45	0.5666667	0	0.04908	1	1	1	1	2.16667	0	0	12.1954	7.765578	17.198787	85.209285
0	0.152175		0.605941	52.5		0	0.07932	1	1	1	1	3.5	0	0	14.824	9.082048	18.072201	91.802797
0	0.211802	4.2352941	0.62528	41.666667	1.7	0	0.05119	1	1	1	1	1.55	0	0	12.774	7.406636	18.828254	88.874756
0	0.14849	31.5	0.549495	45	0.2	0	0.05825	1	1	1	1	2.83333	0	0	12.8871	8.325529	20.007663	101.12992
0	0.320788	48.888889	0.813056	61.666667	0.1666667	0	0.03463	1	1	1	1	2.5	0	0	10.6333	6.086874	20.132638	60.121386
0	0.32086	57.75	0.753704	58.333333	0.125	0	0.06266	1	1	1	1	3.16667	0	0	12.9684	9.120403	19.808697	108.79039
0	0.216899	46.25	0.55458	51.666667	0.15	0	0.04755	1	1	1	1	3.33333	0	0	11.9805	7.248426	18.693124	82.549368
0	0.334278	15.369565	0.72375	88	1.2	0	0.0137	1	1	1	1	1.6	0	0	5.54995	3.930761	18.001756	19.820513
0	0.316311	21.227273	1.017778	65	1.5	0	0.02711	1	1	1	1	2	0	0	9.00583	6.062003	20.922523	47.0675
0	0.317974		0.530079	61.666667		0	0.01351	1	1	1	1	2.5	0	0	6.56328	4.053439	19.774212	23.450167
0	0.324148	19.066667	1	72	1.1666667	16.666667	0.02639	1	1	1	1	2	0	0	8.78721	5.686437	21.168393	45.82462
0	0.26177	4.1	0.486189	55	2	0	0.04052	1	1	1	1	3.83333	0	0	11.4031	6.832679	17.247303	70.341116
0	0.223114	79	0.576294	52	0.1	0	0.0514	1	1	1	1	1.8	0	0	12.1686	7.795654	17.766225	74.360511
0	0.197807	39.141667	0.540428	46.666667	1.05	0	0.05791	1	1	1	1	2.33333	0	0	13.3922	7.485774	17.988233	100.53107
0	0.220052	37.115909	0.689317	56.666667	1.575	0	0.07528	1	1	1	1	2.66667	0	0	14.1783	9.206748	19.013325	130.69667
0	0.166533	1.8888889	0.669634	50	4.5	0	0.07968	1	1	1	1	3	0	0	14.4616	9.570077	17.360426	138.32581
0	0.157648	15.232164	0.691099	48	3.4666667	0	0.08074	1	1	1	1	2.4	0	0	15.1792	8.876618	16.665522	116.81727
0	0.173077	57.875	0.458894	51.666667	1.1666667	0	0.04977	1	1	1	1	3.33333	0	0	12.6283	7.389185	19.911861	86.411578
0	0.20794	46.318182	0.669114	52	1.2	0	0.08134	1	1	1	1	3.6	0	0	15.4319	8.576721	18.850232	117.67921
0	0.123696		0.535898	51.666667		0	0.08052	1	1	1	1	1.83333	0	0	13.7275	10.77732	20.421302	139.79472
0	0.141673	3.5	0.610724	53.333333	3	0	0.08566	1	1	1	1	2.5	0	0	14.1819	10.81499	17.710748	148.70803
0	0.235473	26.935	0.888419	51.666667	1.74	0	0.06356	1	1	1	1	3.16667	0	0	13.0808	8.70535	18.407536	110.35505
0	0.129573	21.2	0.662786	46.666667	0.5	0	0.09444	1	1	1	1	2.5	0	0	15.1927	10.44856	18.546913	163.95054
0	0.21136	1.1847826	0.980357	58	9.2	0	0.07447	1	1	1	1	2.2	0	0	13.3924	10.26387	19.753864	107.73699
0	0.167921		0.516165	45		0	0.07626	1	1	1	1	1.66667	0	0	13.6094	10.27475	21.758883	132.39289
0	0.144555	3.625	0.64237	52	2.4	0	0.06206	1	1	1	1	1.8	0	0	12.4271	9.793416	19.030314	89.787156
0	0.111897		0.50917	51.666667		0	0.04704	1	1	1	1	1	0	0	10.9476	8.959251	18.891474	81.666484
0	0.257023	9.8108108	0.853652	65	3.7	0	0.14427	1	1	1	1	1	0	0	17.2754	12.69667	20.282169	250.4715
0	0.091424		0.590809	52		0	0.08199	1	1	1	1	1	0	0	14.3257	10.00329	17.670619	118.62581
0	0.142		0.517933	48.333333		0	0.104	1	1	1	1	2.33333	0	0	14.6452	12.45357	17.688096	180.55771
0	0.176354	79	0.635527	53.333333	0.1	0	0.04597	1	1	1	1	1	0	0	10.8988	8.768874	21.320355	79.802208
0	0.130436	46	0.734338	50	0.2	0	0.06742	1	1	1	1	2.33333	0	0	12.8126	10.18033	21.386299	117.04769
0	0.166678	12	0.642186	46.666667	0.8	0	0.07799	1	1	1	1	2.16667	0	0	14.4035	9.418796	17.419887	135.40188
0	0.218543	1.7462687	0.81596	58	6.7	0	0.08838	1	1	1	1	1.8	0	0	14.9165	10.10149	20.412857	127.87159

Plot Data Set - Grootgeluk

BLOCK	SEEDLOT	PROVENANCE	SITE	DATEESTS	DATEASST	PLOTX2	PLOTY2	_TYPE_	_FREQ_	DBH1	HEIGHT	SURV	GMEAN	GSUM	MEANPLOT	WHORLS	BRANCHES	DIAB	FORK	FOXTAIL	NO_TOTAL	NO_G	NOHEIGHT	KRAFT1	KRAFT2	KRAFT3	KRAFT4	KRAFT5	KRATM	KRSTEM	STEM1	STEM2	STEM3	STEM4	STEM5	STEM6	STEM7	STEM8
5	01517/85	HOTHIEN	Grootgel	291	898	69	3	576	0	0	6	13.933333	9.05	100	0.0156166	0.0937	19.166667	12.1666667	4.833333	2.366667	0	16.666667	6	6	6	0	33.333333	16.666667	5.833333	0	0	0	0	33.3333333	50	16.666667	0
5	01518/85	THACPRENN	Grootgel	291	898	73	3	784	0	0	6	15	9.36	83.333333	0.01891607	0.09458	20	13	5.8	3	0.2	20	6	5	5	0	0	20	80	0	3.8	5.8	0	0	20	0	20	0	60	0
5	01521/85	NONGKRATING	Grootgel	291	898	79	2	1156	1	0	6	10.36	6.98	83.333333	0.00949771	0.047489	18.75	10.2	5.8	1.94	0.6	0	6	5	5	0	20	80	0	0	2.8	4.8	0	20	0	0	40	40	0	0
5	01522/85	DOISUTHEP	Grootgel	291	898	82	2	1369	1	0	6	13.18	8.4	83.333333	0.01374607	0.06873	17.4	12.4	5.2	2.16	0	0	6	5	5	0	0	100	0	0	3	5.2	0	0	0	0	80	20	0	0
5	01524/85	PHUKRADUNG	Grootgel	291	898	90	2	2025	1	0	6	12.666667	7.4333333	100	0.01816035	0.108962	17.5	12	5.166667	2.083333	0.666667	16.666667	6	6	6	0	16.666667	50	33.333333	0	3.166667	5.666667	0	0	0	0	33.3333333	66.666667	0	0
5	01525/85	NAMNOW	Grootgel	291	898	88	2	1849	1	0	6	11.583333	7.3166667	100	0.01187738	0.071264	18.2	11	4.666667	2.683333	0.333333	16.666667	6	6	6	0	33.333333	66.666667	0	0	2.666667	4.333333	16.66667	0	0	16.666667	50	16.666667	0	0
5	01623/86	SHANGBAI	Grootgel	291	898	77	1	1024	4	0	6	10.616667	6.0166667	100	0.01498423	0.089905	19.333333	6.16666667	4.833333	3.483333	1	16.666667	6	6	6	0	0	66.666667	33.333333	0	3.333333	5	0	0	16.666667	0	50	33.333333	0	0
5	01625/86	BAOSHAN(2)	Grootgel	291	898	79	1	1156	4	0	6	8.7833333	6.3833333	100	0.01230219	0.073813	19.4	9.16666667	3.333333	2.366667	0.833333	0	6	6	6	16.66667	16.666667	50	16.666667	0	2.666667	5	0	0	16.666667	16.666667	16.6666667	50	0	0
5	01626/86	MAGUAN	Grootgel	291	898	80	1	1225	4	0	6	10	6.15	100	0.01365532	0.081932	18.4	9	4.333333	2.3	0.666667	0	6	6	6	16.66667	16.666667	16.666667	33.333333	16.666667	3.166667	4.833333	0	16.666667	0	16.666667	33.3333333	16.666667	16.666667	0
5	01628/86	HUIZE	Grootgel	291	898	81	1	1296	4	0	6	6.54	5.28	83.333333	0.00395403	0.01977	19.5	4.4	4	1.94	0.2	20	6	5	5	40	40	20	0	0	1.8	4.6	0	40	0	0	0	0	40	20	0
5	01629/86	LANPING	Grootgel	291	898	76	1	961	4	0	6	7.9333333	4.6666667	100	0.0062958	0.037775	19.5	4.83333333	4.5	2.683333	0.666667	0	6	6	6	0	50	33.333333	16.666667	0	2.666667	5.5	0	16.666667	0	0	0	66.666667	16.666667	0
5	01633/86	SHANGSI	Grootgel	291	898	78	1	1089	4	0	6	6.78	3.62	83.333333	0.00405507	0.020275	19.5	4.2	3.4	2.32	0	0	6	5	5	0	80	0	20	0	2.4	3.8	0	20	40	0	20	20	0	0
5	01634/86	DUKOU	Grootgel	291	898	75	1	900	4	0	6	8.65	4.7	100	0.00597968	0.035878	21.8	4.5	5.333333	3.016667	0.333333	0	6	6	6	0	50	16.666667	33.333333	0	2.833333	4.333333	0	33.333333	0	16.666667	0	50	0	0
5	01635/86	JINDUNG(1)	Grootgel	291	898	84	1	1521	4	0	6	13.016667	8.3166667	100	0.01510365	0.090622	18.666667	13.3333333	5.166667	2.966667	0.166667	0	6	6	6	0	0	16.666667	50	33.333333	4.166667	5.166667	0	0	0	33.333333	16.6666667	50	0	0
5	01637/86	JINGHONG	Grootgel	291	898	86	1	1681	4	0	6	11.45	7.425	66.666667	0.01474216	0.058969	14.75	11.5	5	3.225	0.75	0	6	4	4	0	0	25	50	25	4	5	0	0	0	0	100	0	0	0
5	01638/86	LANCANG	Grootgel	291	898	85	1	1600	4	0	6	14.92	8.34	83.333333	0.01934821	0.096741	14.6	12.4	5.4	2.78	0.8	0	6	5	5	0	0	20	20	60	4.4	5.8	0	0	0	0	40	40	20	0
5	01639/86	SIMAO	Grootgel	291	898	83	1	1444	4	0	6	14.02	9.26	83.333333	0.0171545	0.085773	17.8	12.2	5.4	2.62	0.2	20	6	5	5	0	0	40	60	0	3.6	5.4	0	0	0	0	20	40	20	20	0
5	01680/86	DAKHA	Grootgel	291	898	81	3	1296	0	0	6	12.183333	8.7666667	100	0.01229525	0.073772	20.166667	11.6666667	4.333333	1.966667	0	0	6	6	6	0	50	16.666667	16.666667	16.666667	3	5.166667	0	0	16.666667	0	16.666667	16.666667	0	0
5	01766/88	WATCHAN	Grootgel	291	898	89	2	1936	1	0	6	11.616667	7.95	100	0.01319057	0.079143	16.666667	11.3333333	4.833333	1.816667	0.166667	16.666667	6	6	6	0	33.333333	50	0	16.666667	3	4.833333	0	0	0	0	50	16.6666667	33.333333	0	0
5	01772/88	ZOKHUA	Grootgel	291	898	72	1	729	4	0	6	8	5.38	83.333333	0.00700543	0.035027	18.666667	11.2	3.8	1.56	0.6	0	6	5	5	0	40	60	0	0	2.6	4.4	0	20	20	0	20	40	0	0
5	01773/88	AUNGBAN	Grootgel	291	898	73	1	784	4	0	6	11.566667	6.2	100	0.01308411	0.078505	16.166667	10.1666667	4.333333	2.733333	0.833333	0	6	6	6	0	0	66.666667	33.333333	0	3.333333	4.333333	0	0	0	16.666667	33.333333	50	0	0	0
5	01776/88	JOHNMEIKLECSO	Grootgel	291	898	66	2	441	1	0	6	14.16	10.06	83.333333	0.01579129	0.078956	21.2	16.8	4.8	1.8	0	0	6	5	5	0	0	100	0	0	3	6.4	0	0	0	0	0	60	40	0	0
5	01778/88	ZAMBIACSO	Grootgel	291	898	62	2	289	1	0	6	13.766667	9.3333333	100	0.01514726	0.090884	17.666667	14.8333333	5.166667	1.783333	0.166667	0	6	6	6	0	16.666667	66.666667	16.666667	0	3	6.666667	0	0	0	0	16.6666667	16.666667	50	16.666667	0
5	01781/88	JINGDUNG(3)	Grootgel	291	898	82	1	1369	4	0	6	12.566667	8.8166667	100	0.01629807	0.097788	19.166667	12	4.333333	2.166667	0.333333	0	6	6	6	0	16.666667	50	16.666667	16.666667	3.333333	5.333333	0	0	0	16.666667	33.333333	50	0	0
5	01783/88	BODANA(A8)	Grootgel	291	898	65	2	400	1	0	6	16.14	9.76	83.333333	0.02054879	0.102744	21	13.8	5	2.66	0.4	0	6	5	5	0	0	60	40	0	3.4	6.2	0	0	0	0	0	80	20	0
5	01786/88	MORARANO	Grootgel	291	898	67	2	484	1	0	6	15.666667	10.683333	100	0.02050439	0.123026	18.333333	13	5.333333	1.95	0.166667	0	6	6	6	0	0	33.3333333	66.666667	0	3.666667	6.833333	0	0	0	0	0	16.666667	83.333333	0	0
5	15133	CONTROL(15133)	Grootgel	291	898	87	3	1764	0	0	6	13.466667	8.45	100	0.01577321	0.094639	23.2	15.1666667	4.833333	2.4	0.166667	0	6	6	6	16.66667	0	16.666667	66.666667	0	3.333333	7.166667	0	0	0	0	0	0	0	83.333333	16.666667
5	23184	CONTROL(23184)	Grootgel	291	898	88	3	1849	0	0	6	13.1	8.98	83.333333	0.01555149	0.077757	22.2	14.4	4.8	1.98	0.4	0	6	5	5	0	20	60	20	0	3	5.2	0	0	0	0	20	40	40	0	0	0
5	23493	CONTROL(23493)	Grootgel	291	898	89	3	1936	0	0	6	11.15	7.1833333	100	0.01023694	0.061422	20	11.5	4	1.75	0.166667	16.666667	6	6	6	0	66.666667	33.333333	0	0	2.333333	6.666667	0	0	0	0	0	0	33.333333	66.666667	0
5	5/87	CONTROL(5/87)	Grootgel	291	898	85	3	1600	0	0	6	15.7	11.516667	100	0.0210079	0.126047	23.333333	17	4.166667	3.266667	0.166667	0	6	6	6	0	0	0	16.666667	83.333333	4.833333	6	0	16.666667	0	0	16.666667	0	50	16.666667	0
5	9	CONTROL(9)	Grootgel	291	898	90	3	2025	0	0	6	14.25	8.1833333	100	0.01611801	0.096708	17.833333	12.3333333	3	1.633333	0	16.666667	6	6	6	0	0	100	0	0	3	6.833333	0	0	0	0	0	16.666667	83.333333	0	0
5	m2012	CONTROL(m2012)	Grootgel	291	898	86	3	1681	0	0	6	13.1	9.8833333	100	0.01476161	0.08857	19.833333	20.3333333	4.333333	2.75	0.166667	0	6	6	6	0	16.666667	0	66.666667	16.666667	3.833333	6.333333	0	0	0	0	0	16.666667	33.333333	50	0	0
6	01447/84	MT.PROVINCE	Grootgel	291	898	67	5	484	4	0	6	11.816667	9.55	100	0.01355632	0.081338	19	14.1666667	4.166667	1.7	0.5	16.666667	6	6	6	0	33.333333	66.666667	0	0	2.666667	5.5	0	0	0	0	16.666667	16.666667	66.666667	0	0
6	01506/85	TARLAC	Grootgel	291	898	66	5	441	4	0	6	12.783333	10.05	100	0.01337377	0.080243	21	15.1666667	4.666667	1.75	0	0	6	6	6	0	33.333333	66.666667	0	0	2.666667	5	0	0	16.666667	16.666667	16.666667	16.6666667	50	0	0
6	01515/85	DATHIEN	Grootgel	291	898	73	5	784	4	0	6	12.816667	8.6166667	100	0.01314304	0.078858	18.166667	16	5	2.333333	0	16.666667	6	6	6	0	16.666667	66.666667	16.666667	0	3	6.666667	0	0	0	0	16.666667	0	83.333333	0	0
6	01516/85	XUANTHO	Grootgel	291	898	68	5	529	4	0	6	12.666667	10.4	100	0.01653536	0.099212	18.833333	14.1666667	4.666667	2.283333	0.333333	50	6	6	6	0	16.666667	83.333333	0	0	2.833333	5.833333	0	0	0	0	16.666667	16.666667	33.333333	33.333333	0
6	01517/85	HOTHIEN	Grootgel	291	898	70	5	625	4	0	6	15.8	10.416667	100	0.02035079	0.122105	20	15	5.5	2.516667	0.666667	33.333333	6	6	6	0	0	50	33.333333	16.666667	3.666667	5.166667	0	0	0	0	33.333333	16.6666667	50	0	0
6	01518/85	THACPRENN	Grootgel	291	898	72	5	729	4	0	6	12.216667	8.7333333	100	0.01322043	0.079323	17.666667	14.6666667	4.666667	1.95	0.333333	16.666667	6	6	6	0	16.666667	83.333333	0	0	2.833333	6	0	0	0	0	16.666667	0	50	33.333333	0
6	01521/85	NONGKRATING	Grootgel	291	898	84	5	1521	4	0	6	12.516667	7.3166667	100	0.01384481	0.083069	17.4	13.3333333	4.666667	2.066667	0.166667	33.333333	6	6	6	16.66667	0	66.666667	16.666667	0	2.833333	5.666667	0	0	0	0	50	33.333333	16.666667	0	0
6	01522/85	DOISUTHEP	Grootgel	291	898	85	5	1600	4	0	6	12.85	7.9166667	100	0.01736298	0.104178	17.333333	15.8333333	5.333333	1.916667	0.666667	16.666667	6	6	6	0	0	66.666667	33.333333	0	3.333333	6.166667	0	0	0	0	16.6666667	50	33.333333	0	0
6	01524/85	PHUKRADUNG	Grootgel	291	898	88	5	1849	4	0	6	13.316667	8.3333333	100	0.01509187	0.090551	17.666667	14.6666667	5.333333	2.516667	0.166667	33.333333	6	6	6	0	0	66.666667	33.333333	0	0.333333	5	0	0	0	33.333333	33.3333333	33.333333	0	0	0
6	01525/85	NAMNOW	Grootgel	291	898	90	4	2025	1	0	6	14.266667	7.7166667	100	0.01684624	0.101077	19.666667	14.3333333	4.833333	2.516667	0.166667	16.666667	6	6	6	0	16.666667	33.333333	50	0	3.333333	6	0	0	0	0	0	100	0	0	0
6	01623/86	SHANGBAI	Grootgel	291	898	87	6	1764	9	0	6	10.78	6.5	83.333333	0.0128359	0.06418	20.4	6.2	5	3.24	0.4	0	6	5	5	0	60	40	0	0	2.4	4	0	20	40	0	0	40	0	0	0
6	01625/86	BAOSHAN(2)	Grootgel	291	898	88	6	1849	9	0	6	12.16	7.98	83.333333	0.0159599	0.0798	20.2	9	4.8	3.24	0.4	20	6	5	5	0	0	100	0	0	3	5.2	0	0	0	0	20	40	40	0	0	0
6	01626/86	MAGUAN	Grootgel	291	898	89	6	1936	9	0	6	11.1	6	83.333333	0.01289891	0.064495	18.25	10	3.8	3.06	0.2	0	6	5	5	0	40	20	0	40	3.4	4.8	0	0	0	0	40	40	20	0	0
6	01628/86	HUIZE	Grootgel	291	898	84	6	1521	9	0	6	5.8	3.7666667	100	0.00322588	0.019355	18.333333	4.83333333	4.166667	2.283333	0.166667	0	6	6	6	16.66667	83.333333	0	0	0	1.833333	4.166667	0	16.666667	33.333333	16.666667	0	16.666667	16.666667	0
6	01629/86	LANPING	Grootgel	291	898	86	6	1681	9	0	6	7.9833333	4.7833333	100	0.00559926	0.033596	18.4	4.83333333	3.833333	2.733333	0.333333	16.666667	6	6	6	0	83.333333	16.666667	0	0	2.166667	5.166667	0	0	16.666667	16.666667	16.6666667	33.333333	16.666667	0	0
6	01633/86	SHANGSI	Grootgel	291	898	85	6	1600	9	0	6	8.4833333	4.5	100	0.00818767	0.049126	17.25	5.33333333	4	2.916667	0.333333	16.666667	6	6	6	0	66.666667	0	33.333333	0	2.666667	2.666667	0	33.333333	66.666667	0	0	0	0	0	0
6	01634/86	DUKOU	Grootgel	291	898	90	6	2025	9	0	6	8.1	5.08	83.333333	0.0071137	0.035569	19.6	4.8	4	3.06	0.6	0	6	5	5	0	80	20	0	0	2.2	3.2	0	0	0	80	20	0	0	0	0
6	01635/86	JINDUNG(1)	Grootgel	291	898	70	4	625	1	0	6	10.6	6.325	66.666667	0.01232629	0.049305	16.75	11.5	5	2.825	1	0	6	4	4	0	0	75	25	0	3.25	4.25	0	25	0	0	25	25	25	0	0
6	01637/86	JINGHONG	Grootgel	291	898	68	4	529	1	0	6	13.766667	8.8333333	100	0.01761611	0.105697	19.666667	14	5.333333	2.95	0.333333	0	6	6	6	0	0	16.666667	66.666667	16.666667	4	5.833333	0	0	0	0	16.6666667	83.333333	0	0	0
6	01638/86	LANCANG	Grootgel	291	898	71	4	676	1	0	6	11	6.9833333	100	0.01265275	0.075917	17	13.6666667	4.166667	3	0.333333	0	6	6	6	0	16.666667	33.333333	50	0	3.333333	5	0	0	0	0	16.666667	66.666667	16.666667	0	0
6	01639/86	SIMAO	Grootgel	291	898	69	4	576	1	0	6	12.38	8.08	83.333333	0.01679354	0.083968	17.25	13.4	4.6	2.02	0.8	0	6	5	5	20	0	60	20	0	2.8	5.8	0	0	0	0	0	0	20	80	0	0
6	01680/86	DAKHA	Grootgel	291	898	83	6	1444	9	0	6	14.616667	8.9666667	100	0.01840536	0.110432	18.166667	12.8333333	4.333333	3.183333	0.166667	16.666667	6	6	6	0	16.666667	33.333333	33.333333	16.666667	3.5	5.833333	0	0	0	0	16.666667	83.333333	0	0	0
6	01766/88	WATCHAN	Grootgel	291	898	89	4	1936	1	0	6	12.333333	7.6166667	100	0.0188688	0.113213	16.333333	14.3333333	4.5	2.15	1	0	6	6	6	0	0	33.333333	66.666667	0	3.666667	4.833333	0	0	0	0	33.333333	50	16.666667	0	0
6	01772/88	ZOKHUA	Grootgel	291	898	85	4	1600	1	0	6	11.25	8	66.666667	0.01411261	0.05645	19.5	15	4.5	2.35	0.5	0	6	4	4	0	0	75	25	0	3.25	5.75	0	0	0	0	0	25	75	0	0
6	01773/88	AUNGBAN	Grootgel	291	898	79	4	1156	1	0	6	11.966667	7.6666667	100	0.01451123	0.087067	19.166667	14.8333333	5.166667	2.333333	0.666667	16.666667	6	6	6	0	16.666667	33.333333	50	0	3.333333	5.166667	0	0	0	0	33.333333	16.6666667	50	0	0
6	01776/88	JOHNMEIKLECSO	Grootgel	291	898	61	5	256	4	0	6	10.15	7.95	66.666667	0.01113593	0.044544	20.666667	15.5	4	1.225	0.5	0	6	4	4	25	25	25	25	0	2.5	4.75	0	0	0	25	25	0	50	0	0
6	01778/88	ZAMBIACSO	Grootgel	291	898	70	6	625	9	0	6	15.183333	10.816667	100	0.0195157	0.117094	19.666667	14.5	5.333333	3.116667	0.5	0	6	6	6	0	16.666667	50	33.333333	0	3.166667	6.666667	0	0	0	0	0	33.333333	66.666667	0	0
6	01781/88	JINGDUNG(3)	Grootgel	291	898	67	4	484	1	0	6	12.86	8.92	83.333333	0.0149193	0.074597	20.4	10	5.6	2.26	0.8	0	6	5	5	0	0	80	20	0	3.2	5.4	0	0	0	0	20	40	20	20	0	0
6	01783/88	BODANA(A8)	Grootgel	291	898	71	6	676	9	0	6	14.95	10.15	100	0.01805663	0.10834	18.333333	13.3333333	4.333333	3.05	0	33.333333	6	6	6	0	16.666667	33.333333	50	0	3.333333	6.333333	0	0	0	16.666667	16.6666667	0	50	16.666667	0
6	01786/88	MORARANO	Grootgel	291	898	65	6	400	9	0	6	14.966667	10.266667	100	0.01955512	0.117331	18	15	4.666667	2.2	0.166667	0	6	6	6	0	0	50	50	0	3.5	7	0	0	0	0	0	0	33.333333	33.333333	33.333333
6	15133	CONTROL(15133)	Grootgel	291	898	63	4	324	1	0	6	12.533333	9.15	100	0.01255702	0.075342	23	17.1666667	4	2.1	0	0	6	6	6	0	16.666667	66.666667	16.666667	0	3	6.833333	0	0	0	0	0	16.666667	83.333333	0	0
6	23184	CONTROL(23184)	Grootgel	291	898	64	4	361	1	0	6	13.033333	9.3166667	100	0.0136366	0.08182	19.833333	15.5	4.333333	2.083333	0	0	6	6	6	0	33.333333	16.666667	50	0	3.166667	6.5	0	0	0	0	0	50	50	0	0
6	23493	CONTROL(23493)	Grootgel	291	898	65	4	400	1	0	6	10.28	7.72	83.333333	0.00838357	0.041918	20	12.2	3.2	1.38	0	0	6	5	5	0	80	20	0	0	2.2	6.4	0	0	0	0	0	0	60	40	0	0
6	5/87	CONTROL(5/87)	Grootgel	291	898	66	4	441	1	0	6	14.8	10.533333	100	0.01811962	0.108718	23.333333	17.3333333	4.166667	3.4	0.166667	0	6	6	6	0	16.666667	16.666667	50	16.666667	3.666667	6.166667	0	0	0	0	50	16.666667	16.666667	0	0
6	9	CONTROL(9)	Grootgel	291	898	61	4	256	1	0	6	13.6	9.1333333	100	0.01464231	0.087854	18.5	15.1666667	2.833333	1.25	0.166667	16.666667	6	6	6	0	33.333333	66.666667	0	0	2.666667	6.833333	0	0	0	0	0	16.666667	83.333333	0	0
6	m2012	CONTROL(m2012)	Grootgel	291	898	62	4	289	1	0	6	11.733333	9.8666667	100	0.0110584	0.06635	17	23.6666667	3.833333	2.4	0	0	6	6	6	0	16.666667	50	33.333333	0	3.166667	6.666667	0	0	0	0	0	0	33.333333	66.666667	0

Plot Data Set - Grootgeluk

STEM9	BRATIO	FO_INDEX	INTNODE	CROWNPCT	FO_POS	TOP	VTREE	MF	FF	CL	CC	OC	LOTH	APHID	DG	HG	PILCORR	VHA
0	0.169724		0.733469	53.333333		0	0.07304	1	1	1	1	2	0	0	14.0981	9.135666	19.058239	126.80793
0	0.20088	93	0.693187	56	0.1	0	0.08981	1	1	1	1	2.8	0	0	15.5161	9.400361	19.800965	129.93966
0	0.204309	14.214286	0.635919	50	1.15	0	0.04121	1	1	1	1	1.4	0	0	10.9945	7.359902	18.831281	59.625287
0	0.165857		0.651978	50		0	0.06053	1	1	1	1	3.2	0	0	13.2269	8.436122	17.355563	87.571217
0	0.163086	39.708333	0.588495	46.666667	0.25	0	0.07459	1	1	1	1	2.33333	0	0	15.203	7.877342	17.499168	129.50182
0	0.241702	152	0.622657	58.333333	0.1	0	0.05099	1	1	1	1	1.5	0	0	12.295	7.705109	18.204831	88.524523
0	0.332329	53.8	0.92623	81.666667	0.14	0	0.05685	1	1	1	1	2.66667	0	0	13.8097	7.057626	19.506637	98.699203
0	0.277648	61.3	0.662734	66.666667	0.12	0	0.05201	1	1	1	1	1.66667	0	0	12.5129	7.319606	19.637579	90.290743
0	0.230922	81.666667	0.687699	61.666667	0.2	0	0.05865	1	1	1	1	3.33333	0	0	13.1831	7.563808	18.515259	101.81601
0	0.294574	54	1.103333	70	0.1	0	0.01866	1	1	1	1	1.4	0	0	7.09394	5.501862	19.853103	26.996401
0	0.339666	38.411765	0.879167	81.666667	0.925	0	0.02511	1	1	1	1	1.16667	0	0	8.95144	5.391574	19.901238	43.590027
0	0.349952		0.738667	70		0	0.01471	1	1	1	1	1.8	0	0	7.18401	3.844177	19.776653	21.284566
0	0.361814	3.2161172	0.913889	81.666667	1.7	0	0.02067	1	1	1	1	1.5	0	0	8.72382	4.826349	22.115727	35.883936
0	0.226326	74	0.595171	48.333333	0.1	0	0.06517	1	1	1	1	4.16667	0	0	13.8646	8.282003	18.636104	113.14447
0	0.286458	57.666667	0.600189	50	0.1333333	0	0.06329	1	1	1	1	3	0	0	13.6977	8.189058	14.852517	73.257061
0	0.187203	19.726276	0.66819	56	3.425	0	0.08314	1	1	1	1	3.2	0	0	15.6924	8.522834	14.40776	120.28579
0	0.18442	92	0.731852	62	0.1	0	0.08134	1	1	1	1	4.2	0	0	14.776	9.265413	17.68421	117.68283
0	0.16034		0.776335	48.333333		0	0.05943	1	1	1	1	2.5	0	0	12.5094	9.03205	20.206891	103.18073
0	0.157913	90	0.669485	58.333333	0.1	0	0.0588	1	1	1	1	2.16667	0	0	12.9569	8.331392	16.755026	102.07911
0	0.265609	24	0.427802	62	0.65	0	0.03276	1	1	1	1	1.8	0	0	9.44246	6.255917	18.793251	47.397274
0	0.23823	28.866667	0.602556	63.333333	0.6333333	0	0.04826	1	1	1	1	3	0	0	12.9045	7.010614	16.259274	83.779147
0	0.128186		0.579717	48		0	0.08004	1	1	1	1	2.8	0	0	14.1767	10.06537	21.072318	115.79796
0	0.128524	4.3809524	0.600877	48.333333	2.1	0	0.07256	1	1	1	1	3.16667	0	0	13.8846	9.373757	17.572396	125.97674
0	0.17255	60.5	0.695095	61.666667	0.15	0	0.08033	1	1	1	1	3.5	0	0	14.4024	9.603679	19.174329	139.45864
0	0.162778	3.5989305	0.692342	54	2.8	0	0.09905	1	1	1	1	2.8	0	0	16.1719	9.757716	20.704128	143.30111
0	0.128104	7.5833333	0.818565	50	1.2	0	0.11001	1	1	1	1	2.66667	0	0	16.1544	10.85639	18.077668	190.99019
0	0.188519	1.0126582	0.519152	58.333333	7.9	0	0.07334	1	1	1	1	1.83333	0	0	14.1686	8.916152	22.970385	127.33179
0	0.155277	47.65	0.604383	56	3.55	0	0.07332	1	1	1	1	2	0	0	14.0687	9.106247	22.162359	106.07226
0	0.161986	1.4878049	0.588719	55	4.1	0	0.04267	1	1	1	1	1	0	0	11.4144	7.395312	20.128	74.077717
0	0.204284	7.9230769	0.663214	56.666667	1.3	0	0.11871	1	1	1	1	1	0	0	16.3516	11.54351	23.074837	206.09416
0	0.114636		0.689351	60		0	0.06829	1	1	1	1	1.16667	0	0	14.3227	8.235358	17.698006	118.55617
0	0.216103	7.3076923	0.46267	51.666667	1.3	0	0.07677	1	1	1	1	3	0	0	13.7068	10.0236	19.795692	133.27552
0	0.145575	36.41868	0.651555	50	1.1	0	0.07096	1	1	1	1	2	0	0	13.1353	10.10755	19.071371	123.19653
0	0.142857		0.637738	56.666667		0	0.07061	1	1	1	1	1.5	0	0	13.0465	10.21239	20.989258	122.57863
0	0.182023		0.509626	50		0	0.06075	1	1	1	1	2.16667	0	0	12.9335	8.750901	18.153093	105.47035
0	0.182867	109.5	0.825763	45	0.1	0	0.09088	1	1	1	1	1.83333	0	0	14.5069	10.1297	18.832501	157.77169
0	0.158708	34.097143	0.689028	56.666667	1.5666667	0	0.10558	1	1	1	1	2	0	0	16.0938	10.52984	19.733009	183.30693
0	0.158382	25.964286	0.56764	51.666667	1.15	0	0.06229	1	1	1	1	2.5	0	0	12.9715	8.996754	17.70406	108.14142
0	0.171389	39.5	0.526174	46.666667	0.2	0	0.0577	1	1	1	1	2.83333	0	0	13.2743	7.657662	17.272318	100.17409
0	0.152113	102.66667	0.472372	51.666667	0.1	0	0.07488	1	1	1	1	3	0	0	14.8655	8.119412	17.316928	130.00063
0	0.186803	76	0.54824	50	0.1	0	0.06627	1	1	1	1	2.66667	0	0	13.8592	8.439288	17.610621	115.04519
0	0.176037	36	0.509191	60	0.2	0	0.06841	1	1	1	1	2.5	0	0	14.6426	7.823629	19.529924	118.75942
0	0.298892	65.5	1.000452	70	0.1	0	0.04984	1	1	1	1	2.4	0	0	12.7815	6.658529	20.55943	72.105139
0	0.268512	86	0.865806	60	0.1	0	0.07289	1	1	1	1	3.8	0	0	14.2522	8.273334	20.242207	105.44766
0	0.31259	79	0.592679	66	0.1	0	0.05202	1	1	1	1	3	0	0	12.8128	7.018191	18.263325	75.265039
0	0.407508	42	0.679167	75	0.1	0	0.01423	1	1	1	1	1.83333	0	0	6.40755	4.061252	18.833673	24.699484
0	0.343841	27.111111	0.891667	70	0.95	0	0.02091	1	1	1	1	1.16667	0	0	8.44176	4.99408	18.763296	36.3084
0	0.358609	58.5	0.750278	71.666667	0.1	0	0.02976	1	1	1	1	3.5	0	0	10.2082	5.634759	17.494799	51.671563
0	0.374661	71.5	0.958	76	0.1	0	0.02856	1	1	1	1	1.4	0	0	9.51515	5.952694	19.987081	41.318505
0	0.267312	23.128307	0.513462	40	1.3	0	0.0468	1	1	1	1	4	0	0	12.5252	6.44088	16.92472	54.169589
0	0.21972	20.372881	0.599219	50	3.05	0	0.0811	1	1	1	1	2.5	0	0	14.9735	9.136341	19.572396	140.80245
0	0.265575	25.9	0.484096	63.333333	0.35	0	0.05115	1	1	1	1	2.5	0	0	12.69	7.235897	17.140742	88.797913
0	0.169167	18.336721	0.560736	48	1.5	0	0.07861	1	1	1	1	2.4	0	0	14.6197	8.863442	17.104055	113.73409
0	0.209331	85	0.666057	56.666667	0.1	0	0.08452	1	1	1	1	4.16667	0	0	15.3052	9.052963	18.000193	146.73127
0	0.178518	63.06	0.499302	55	0.3	0	0.08046	1	1	1	1	2.66667	0	0	15.4967	7.943841	16.360816	139.69486
0	0.210606	62.75	0.501525	55	0.15	0	0.06357	1	1	1	1	3.5	0	0	13.4021	9.885298	19.619506	73.577332
0	0.195217	12.157496	0.489391	55	1.1333333	0	0.06197	1	1	1	1	3.66667	0	0	13.59	8.223926	19.225296	107.57901
0	0.114489	10.173913	0.444426	42.5	2.3	0	0.06197	1	1	1	1	1.25	0	0	11.905	9.878687	20.626194	71.72633
0	0.199591	37.674786	0.810653	53.333333	3.9666667	0	0.10521	1	1	1	1	2.66667	0	0	15.7601	10.82143	19.452058	182.65196
0	0.176463	88.5	0.909952	54	0.2	0	0.07104	1	1	1	1	2.6	0	0	13.7798	9.228633	20.382745	102.77454
0	0.203311		0.806653	46.666667		0	0.09349	1	1	1	1	2.5	0	0	15.1595	10.31137	18.138545	162.30669
0	0.146977	14.571429	0.66288	43.333333	0.7	0	0.10034	1	1	1	1	3	0	0	15.776	10.29784	17.803796	174.20069
0	0.164715		0.513156	53.333333		0	0.06073	1	1	1	1	1.5	0	0	12.6419	9.231091	23.010494	105.43132
0	0.16046		0.572963	50		0	0.06616	1	1	1	1	1.66667	0	0	13.1741	9.376878	19.801355	114.85504
0	0.134481		0.645574	48		0	0.03737	1	1	1	1	1	0	0	10.3296	7.794975	20.201902	54.066226
0	0.235517	1.3424658	0.591336	68.333333	7.3	0	0.09756	1	1	1	1	1	0	0	15.186	10.68199	23.151287	169.38227
0	0.09204	1.9090909	0.575466	56.666667	4.4	0	0.06917	1	1	1	1	1	0	0	13.6513	9.187256	18.419887	120.09027
0	0.204216		0.396656	55		0	0.05805	1	1	1	1	3	0	0	11.8635	9.96138	17.078449	100.78554