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COMPUTER SOFTWARE FOR DATA ANALYSIS OF TEAK SEED PRODUCTION AREAS (SPA Analytics 1.0)

(Final Report of the Extension Project - KFRI Ext-231/2012
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Part - A

User Guide

SPA Analytics 1.0 User Guide

In order to set up Seed Production Areas (SPAs), SPA Analytics helps to prepare the list of inferior trees to be culled by ranking the trees based on traits such as height, clear bole height (CBH), girth at breast-height (GBH), straightness and roundness of the stem, health and crown characteristics of the trees. The software SPA Analytics was developed using VB.net program.

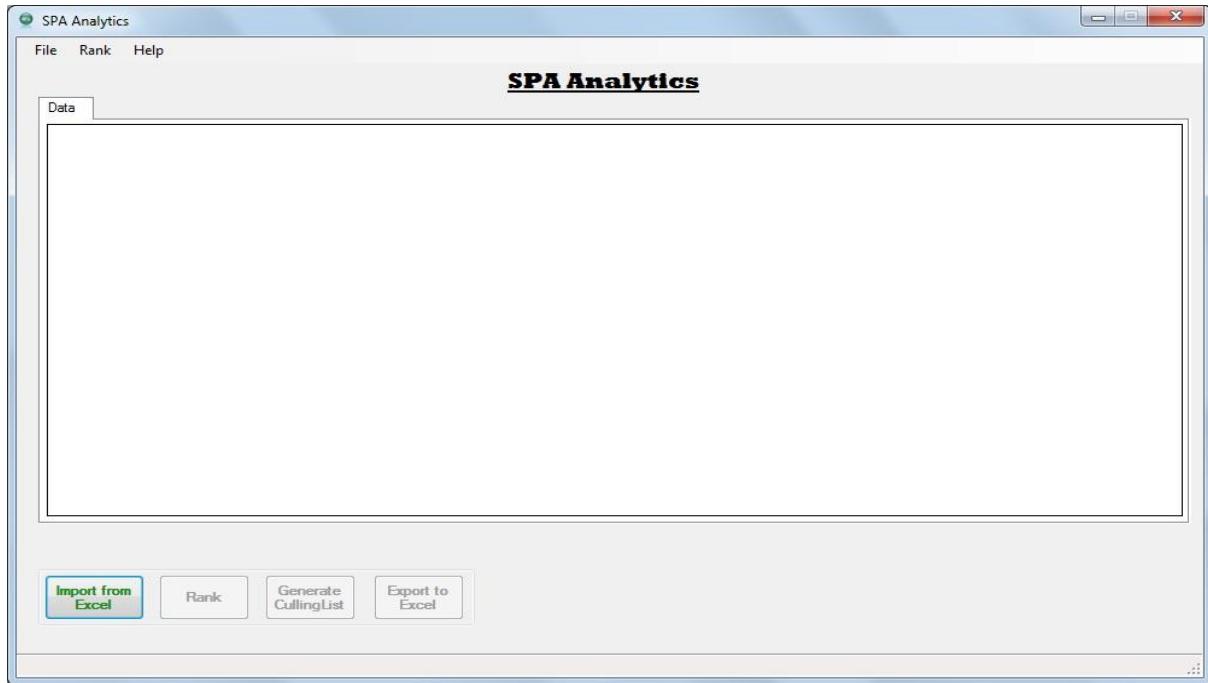
i. System Requirement

- Microsoft® Windows® XP or above
- 256MB of RAM (512MB recommended)
- 25 MB of available hard-disk space
- Microsoft® Office 2003

ii. Operating procedure for SPA Analytics 1.0

The details of the operations involved in the software including data import, ranking trees, preparation of culling list and exporting results to excel are described below.

Image 1: - Main Screen



This is the main screen of SPA Analytics (Image 1). The input data for SPA Analytics should be from Excel 2003 (.xls) and in the following format (example: sample50.xls) (Image 2). Please see that the data is in Sheet 1. The data format of all the variables should be in Numeric. However, 'BlockNo' can be numeric or alphanumeric.

Image 2: Sample input data in excel 2003

The screenshot shows a Microsoft Excel spreadsheet titled 'sample50.xls' in Compatibility Mode. The data is located in Sheet1. The columns are labeled A through U, and the rows are numbered 1 through 25. The first few rows of data are as follows:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	BlockNo	Tree No.	Height	CBH	GBH	Straightne	Roundnes	Health	Crown												
2	A	1	18	8	115	5	9	5	5												
3	A	2	20	12	93	5	9	5	5												
4	A	3	22	11	77	5	5	5	1												
5	A	4	18	8	81	1	1	1	1												
6	B	5	18	7	79	5	5	5	1												
7	B	6	20	7	93	5	5	1	5												
8	B	7	18	7	145	9	1	5	5												
9	B	8	12	4	95	1	1	5	1												
10	C	9	18	6	116	9	9	5	5												
11	C	10	18	14	98	9	5	5	1												
12	C	11	15	6	94	5	5	1	1												
13	C	12	20	7	111	9	5	1	1												
14	A	13	22	14	124	9	1	5	5												
15	C	14	16	10	82	9	9	5	1												
16	B	15	18	10	90	5	5	5	1												
17	A	16	20	3	81	1	5	5	5												
18	B	17	18	10	69	5	1	5	1												
19	C	18	22	12	90	5	5	5	5												
20	C	19	22	6	84	5	5	5	5												
21	A	20	22	6	94	5	5	5	1												
22	B	21	22	14	81	9	9	5	1												
23	A	22	20	10	100	5	5	5	5												
24	B	23	16	8	67	1	5	5	1												
25	C	24	20	7	86	5	5	5	5												

Image 3: - Dialogue box to import input data from Excel



To import excel file click 'Import from Excel' button and then select the input file (Image 3).

Image 4: - Input data in SPA Analytics imported from excel file

The screenshot shows the 'SPA Analytics' software window. The menu bar includes 'File', 'Rank', and 'Help'. The title bar says 'SPA Analytics'. The main area has a 'Data' tab selected, displaying a grid of data with columns: BlockNo, Tree No#, Height, CBH, GBH, Straightness, Roundness, Health, and Crown. The data rows are color-coded by BlockNo (A, B, C). Below the grid, a message says 'Total number of trees : 50'. At the bottom are four buttons: 'Import From Excel' (highlighted in blue), 'Rank', 'Generate Culling List', and 'Export to Excel'.

BlockNo	Tree No#	Height	CBH	GBH	Straightness	Roundness	Health	Crown
A	1	18	8	115	5	9	5	
A	2	20	12	93	5	9	5	
A	3	22	11	77	5	5	5	
A	4	18	8	81	1	1	1	
B	5	18	7	79	5	5	5	
B	6	20	7	93	5	5	1	
B	7	18	7	145	9	1	5	
B	8	12	4	95	1	1	5	
C	9	18	6	116	9	9	5	
C	10	18	14	98	9	5	5	
C	11	15	6	94	5	5	1	
C	12	20	7	111	9	5	1	
A	13	22	14	124	9	1	5	
C	14	16	10	82	9	9	5	
B	15	18	10	90	5	5	5	

Image 4 is the view of the input data in SPA Analytics.

Image 5: - The ranked dataset with statistical values

The screenshot shows the SPA Analytics software interface. At the top, there's a menu bar with File, Rank, and Help. Below the menu is a title bar labeled "SPA Analytics". The main area contains a table titled "Data" with columns: BlockNo, Tree No#, Height, CBH, GBH, Straightness, Roundness, Health, and Crown. The data table lists 18 rows of tree information. Below the table, there are four buttons: Import From Excel, Rank, Generate CullingList, and Export to Excel. To the right of these buttons are three boxes displaying statistical values: Mean (Height = 18.82, CBH = 8.42, GBH = 89.98), Max (Height = 22, CBH = 15, GBH = 145), and Min (Height = 12, CBH = 3, GBH = 59).

Once the data is imported into SPA Analytics you can click ‘Rank’ button to rank the trees. Then SPA Analytics will rank the trees based on the scoring scheme indicated in Part-B of the report and it will also display the Mean, Minimum, and Maximum of Height, GBH, CBH of the trees (Image 5).

Image 6: - Input window for the preparation of culling list

This screenshot shows the SPA Analytics software with an additional input dialog box overlaid on the main window. The dialog box is titled "Calculate" and contains fields for "Total Nos. of Trees : 50", "Enter nos. of trees to be culled in" (with radio buttons for "%" and "number"), and a text input field containing "12". It also shows "Nos. of trees to be culled : 24" and "Nos. of trees to be retained : 76". At the bottom of the dialog are "Gen.Culling List" and "Close" buttons. The main window below the dialog shows the same data table and buttons as in Image 5, along with the same statistical summary boxes.

Culling list (list of inferior trees) can be generated by clicking 'Generate CullingList' button. Enter the desired number of trees to be culled in percentage or in number (Image 6).

Once this step is completed, click on 'Gen.Culling List' button. Then Culling list and Retained list (list of trees retained) will be generated automatically (Image 7).

Image 7: Culling list

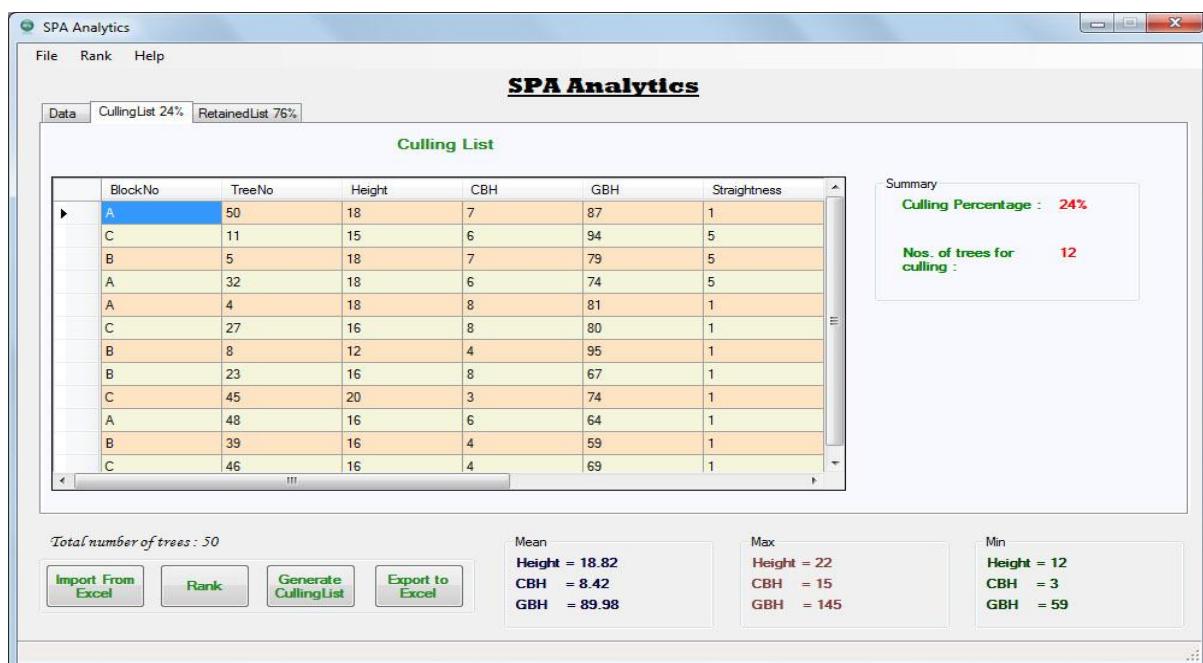
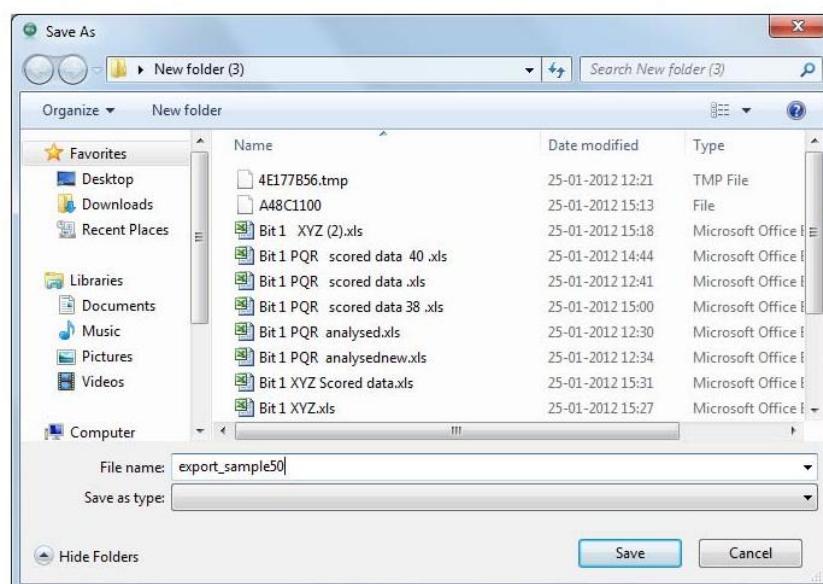
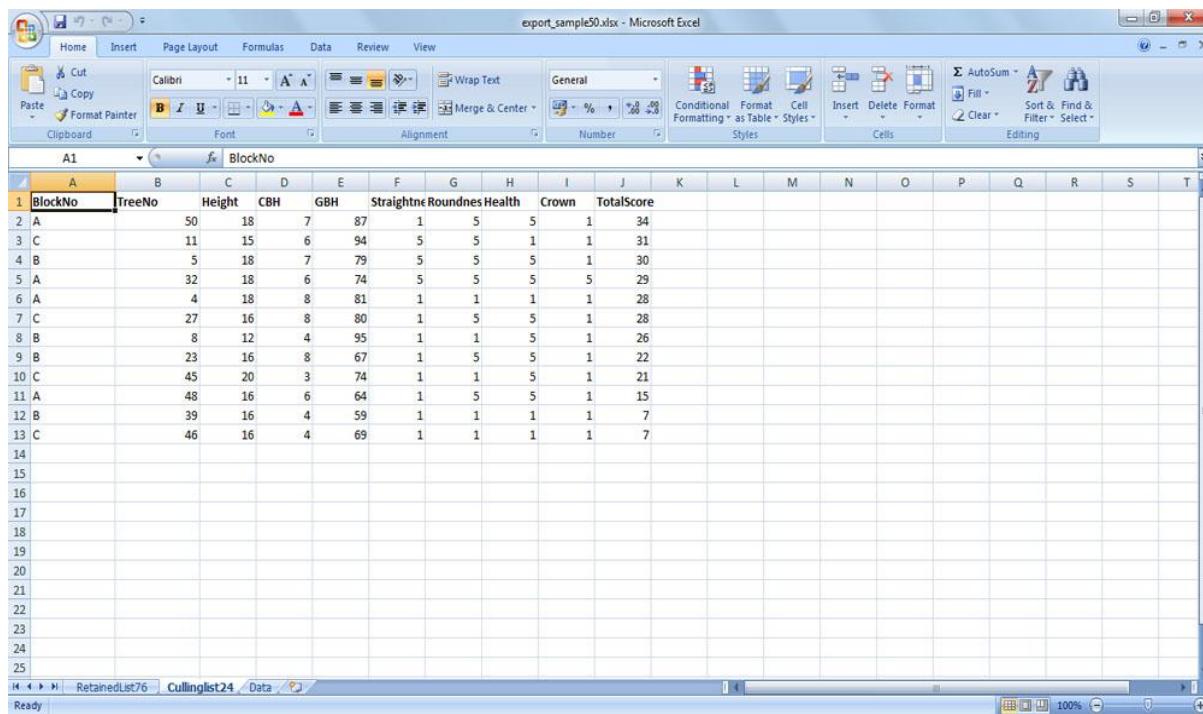


Image 8: -Dialogue box for exporting culling list to excel file



Once the culling list is generated, the same can be exported to a excel file by clicking ‘Export to Excel’ button (Image 8).

Image 9: - Exported culling list in Excel File



The screenshot shows a Microsoft Excel window titled "export_sample50.xlsx - Microsoft Excel". The spreadsheet contains a table of data with 13 rows and 11 columns. The columns are labeled: BlockNo, TreeNo, Height, CBH, GBH, Straightness, Roundness, Health, Crown, and TotalScore. The data includes various numerical values and letters (A, B, C) representing different tree characteristics. The first row is a header, and the second row contains the maximum values for each column. The remaining rows list individual trees with their specific measurements and scores.

BlockNo	TreeNo	Height	CBH	GBH	Straightness	Roundness	Health	Crown	TotalScore	
1	A	50	18	7	87	1	5	5	1	34
2	C	11	15	6	94	5	5	1	1	31
4	B	5	18	7	79	5	5	5	1	30
5	A	32	18	6	74	5	5	5	5	29
6	A	4	18	8	81	1	1	1	1	28
7	C	27	16	8	80	1	5	5	1	28
8	B	8	12	4	95	1	1	5	1	26
9	B	23	16	8	67	1	5	5	1	22
10	C	45	20	3	74	1	1	5	1	21
11	A	48	16	6	64	1	5	5	1	15
12	B	39	16	4	59	1	1	1	1	7
13	C	46	16	4	69	1	1	1	1	7
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										

The above screen shows the culling list exported from SPA Analytics (Image 9). The retained list can also be seen by opening the sheet ‘RetainedList’ in the same excel file. The original data with other computed values are available in the Sheet ‘Data’.

Part - B

Methodology

A BRIEF OUTLINE OF METHODOLOGY FOR ESTABLISHMENT OF SEED PRODUCTION AREAS*

(e.g. teak)

The Seed Production Areas (SPAs) are established by culling the inferior trees from the best of the available plantations/seed stands. An assessment of available plantations for their growth, form and preponderance of superior trees by sampling and ranking them would help in selecting the best plantation for converting into SPA. Further, it is not always the whole stand that is converted into SPA, but only a part of it, for various reasons. When such areas are selected, it is essential to lay sample plots of 0.25 ha (or other suitable size) with 3 to 5% sampling intensity, for making the comparisons. The sample plots help in making comparisons not only between the selected plot and whole seed stand/plantation, but also between stands.

While converting the selected seed stand or a plantation into a Seed Production Area, the trees retained for seed production should be the best trees in the population. This can be achieved by ranking of trees for selected traits and culling out the inferior trees. As the number of trees to be scored for various traits in a seed stand is quite high, it is not easy to score for all the traits as is done in the case of plus tree selection. Hence, a modified method for comparison of different stands and between selected plots within a stand based on preponderance of superior trees and comparison and ranking of trees based on the growth, form and health within the selected plot, is presented below. This format is prepared for teak but it can be used for other species with suitable modifications.

Seed stands are selected by surveying the plantations of size three times the area required for final conversion into SPA. The SPAs are established in different zones of the state based on the site quality and age of the plantations.

Sample plot

Sample plots are required to be laid out in all plantations/seed stands which are identified as having potential for conversion into SPAs. Where portion of the plantation is selected, sample plot is required to be laid out both within the selected area and outside for comparison.

Size and number of sample plots

The size of the sample plot is fixed as 0.25 ha (or other suitable size). The sample plots have to be laid out in each of the identified stands. The number of sample plots depends upon the size of the plantation. Generally, it should be 3 to 5% of the total area. The sample plots have to be laid out both in the selected plot/portion having potential for conversion into SPA and outside, for the purpose of comparison.

*Source: Institute of Forest Genetics and Tree Breeding (IFGTB), Coimbatore.

Scoring of trees in the sample plot

The scoring is done for both quantitative and qualitative traits. The traits selected for scoring are

1. Height (total height) (Table 1)
2. Clear bole height (CBH)(Table 1)
3. Diameter at breast-height (DBH)/Girth at breast-height (GBH) (Table 2)
4. Straightness of stem (Table 3)
5. Roundness of stem (Table 4)
6. Crown (Table 5)
7. Health (Table 6)

The first three are quantitative measurements with high degree of heritability and higher correlation with volume production, whereas the rest of the traits are subjective assessments. The point grade method is followed for scoring the above traits. The maximum score a tree can have is 100. The traits such as height, clear bole height and DBH/GBH are given maximum score of 72 as these are the primary economic traits with high heritability. The percentage superiority of each tree in the sample plot over average of sample plot indicated in the following tables is worked out using the formula

$$\text{Tree height value} - \text{Average height in sample plot}$$

$$\text{The percentage superiority} = \frac{\text{Tree height value} - \text{Average height in sample plot}}{\text{Average height in sample plot}} \times 100$$

Table 1: Scoring scheme for Height/Clear Bole Height

% superiority of each tree in the sample plot over average of sample plot	Score
< - 20	0
-20 to -16	1
-15 to -11	3
-10 to -6	5
-5 to -1	7
1 to 5	9
6 to 10	11
11 to 15	13
16 to 20	15
> 20	18

Table 2: Scoring scheme for DBH/GBH

% Superiority of each tree in the sample plot over average of sample plot	Score
< - 20	0
-20 to -16	2
-15 to -11	6
-10 to -6	10
-5 to -1	14
1 to 5	18
6 to 10	22
11 to 15	26
16 to 20	30
> 20	36

Table 3: Scoring scheme for Straightness

Character	Score
Crooked	1
Wavering with 1 to 2	5
Straight	9

Table 4: Scoring scheme for Roundness

Character	Score
Heavy fluting	1
Medium fluting	5
Round	9

Table 5: Scoring scheme for Health

Character	Score
Heavily infested leading to death	1
Moderately infested	2
Healthy	5

Table 6: Scoring scheme for Crown

Character	Score
Poor crown	1
Well developed crown	5

Table 7: Scoring sheet for evaluation of the sample plot

1. Species :
2. Age (years) :
3. Natural Stand (Yes/No) :
4. Plantation :
5. Seed source :
6. Type of forest :
7. Compartment No. :
8. Range :
9. Division :
10. Site quality :
11. Total area (ha) :
12. Area selected (ha) :

Tree No.	Total height (m)	Clear bole height (m)	GBH (cm)	Height score	Clear bole height score	DBH score	Straightness score	Roundness score	Health score	Crown score	Total score

Analysis

(a) Comparison between stands or between a selected plot and outside within a stand.

Within a sample plot, all the trees are scored using a scoring scheme (Table 7) and scores are summed up. The sum of all the scores of all the sample plots representing a plantation or the selected area is aggregated and the average (mean) score for the stand is calculated.

All these stands of the same/similar age are ranked in a descending order based on (Table 8) the average score of trees in the sample plots representing them (Table 9). Then the stands are selected for conversion into SPAs from the top of the list, based on the area required to meet the seed demand (Table 10).

(b) Comparison of trees within a stand selected for conversion into SPA and identification of trees for culling.

After selecting the stand/plantation, all the trees in the selected seed stand/plantation are numbered and each of the trees is scored for the traits as described above. These trees are ranked in a descending order based on the scores obtained. Predetermined number of trees can be selected from the top of this list for retaining and the remaining trees can be culled out. The number of trees to be retained per hectare depends on the species, site quality and the age of the stand. The cut off score for culling can also vary slightly depending upon how sparsely the trees to be retained are distributed in the stand.

Table 8: Comparative assessment of Plantations/Seed stands

Name of the plantation	Sample plot No.	No. of trees in the sample plot	Total Score
1	1 2 3		
Average score			
2	1 2 3		
Average score			

*Average score = Sum of total scores/Number of trees

Table 9: Ranking of plantations based on average score

Name of the Plantation	Average score of trees in the sample plots

Table 10: Ranking of trees for retention/culling in a plantation identified for conversion into SPA.

Name of the Plantation:

Year of Plantation:

Location:

Tree No.	Score