RESEARCH ON EARLY SELECTION OF SOME FAST-GROWING *EUCALYPTUS UROPHYLLA* FAMILIES AND GOOD TRUNK QUALITY AT THE SEED ORCHARDS IN BA VI DISTRICT, HANOI

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SUMMARY

Research on early selection of some fast-growing *Eucalyptus urophylla* families and good trunk quality of the seed orchards showed that, the average survival rate of 60 *E. urophylla* families in 2.5 year-old stage was 74.9%, and the number of families, whose survival rate are higher than the average in the whole of seed orchards, reached 53.3%. The average growth, and the annual growth rate for diameter, height and trunk volume of 60 families were 7.40 m; 7.79 m, and 16.9 dm^3; and 2.97 cm; 3.11 m and 6.79 dm^3 respectively. There is a significant difference in height and trunk volume between families. The family (No. 93) has the greatest value in height and trunk volume, higher than family (No. 12), which has the smallest height (smaller 1.3 times), and the family (No. 35), which has the smallest trunk volumes (smaller 2.3 times). The quality of the trunk according to single criteria does not differ between families, meanwhile the quality of synthesis (Sqc) is opposite, the family (No. 93) with the highest the quality of synthesis is 30.8; higher than the family (No. 11) with the lowest quality of synthesis, which was lower1.62 times in the same time and condition. Among the 60 families of the seed orchards, only 13 of them selected with fast growth norms ($D_{1.3}$, H_{full} and V), and 10 other families with the quality of synthetis criteria, exceeds level 10% compared to the whole of seed orchards, reaching 21.6% and 16.6% respectively. Out of 60 families, only 6 of them can be chosen including: family No. 93, 34, 45, 31, 15 and No. 92, exceed level 10% both for growth norms and the quality of synthesis criteria compared to the whole of seed orchards. The results of this study are the basis of the proposal of the early selection of some *E. urophylla* families with fast growth, good trunk quality, as well as thinning of slow growth and poor trunk quality of the seed orchards.

Keywords: Breeding selection, Eucalyptus seed orchards, *Eucalyptus urophylla*, growth.

I. INTRODUCTION

Eucalyptus urophylla is an exotic species growing widelyin areas of Vietnam, which is capable of supplying material pulp, wood construction and wood processing industries. *E. urophylla* is a fast-growing, high-yielding species, especially in areas the fertile soil and annual fair rainfall, and now it is a major tree for economic afforestation programs in Vietnam. However, planted forests are only economically viable if they are planted with quality seed sources, preferably selected from the seed orchards (SO) (Diep. V.T., 2010; Kha. L.D., Hung. D.M., 2003; Hoang. V.T., 2001; Wei, X. and Borralho, N.M.G., 1997).

In recent years, *E. urophylla*, *Acacia auriculiformis, A. mangium* and other forest tree species have been studied and selected by Vietnamese Academy of Forest Sciences (VAFS) and Vietnam National University of Forestry (VNUF), from the seed orchards and established in Ba Vi (Ha Noi), Dong Nai, Long An, etc. to provide high quality seedlings for plantation needs (MARD, 2003; MARD, 2007; Hoang. V.T., 2001; Kha. L.D., Hung. D.M., 2003).

However, cross-pollinating behavior of *E.urophylla* has created a strong genetic division, so the seeds collected from a dominant tree also differ significantly. Thus, phenotypic and genotypic pruning is one of the important tasks that need to be carried out during the construction and establishment of the seed orchards (MARD, 2003; MARD, 2007; Diep. V.T.,2010; Wei, X. and Borralho, N.M.G., 1997).

Therefore, evaluation of growth and trunk quality for early selection of some of fast-growing in several *E. urophylla* families of the seed orchards in Ba Vi District, Hanoi is very necessary, scientifically significantly and practical valuble. The results of this study are the base ofreference in early selection of some promising families for clonal trials, as well as thinning of poorly growing families. This article introduces some initial results obtained during the study.

II. RESEARCH METHODOLOGY

2.1. Research materials and experimental site

Material of research was the seed orchards to which belong to 60 *E.urophylla* families, planted in August 2014 in Cam Quy commune, Ba Vi district, Hanoi.

The seed orchards was designed as according to a randomized block of 8 blocks. Each of them planted with 3 trees in rows, area of 1.0 hectares, the dimension of each hole were 40 x 40 x 40 cm, and regularly fertilized with 2.0 kg of manure and 200 grams NPK per tree.

2.2. Content and research method

2.2.1. Research content

The research contents included: (i) evaluation of some growth norms in the *E.urophylla* families; (ii) assessment of some trunk quality criteria in *E. urophylla* families; and (iii) Early selection of some fast growing and good trunk quality *E.urophylla* families at the seed orchards.

2.2.2. Research methods

Evaluating some growth norms

Growth norms were monitored and measured according to survey method about conventional forest including diameter at breast height ($D_{1.3}$) with vernier caliper and full height (H_{full}) with measuring rod.

The trunk volume with bark (V) was calculated with equation (1) (Kha, Hung, 2003) as following:

$$V = \frac{\pi \times D_{1.3}^2}{4} \times H_{full} \times f \quad (1)$$

Where: V - trunk volume with bark; $D_{1.3}$ - diameter at breast height; H_{full} - full height of tree and f - form coefficient (assuming as 0.5).

Survival rate (SR) is calculated as percentage of the number of living trees out of the number of total after one year of follow-up.

Evaluating some quality criteria of trunk:

+ Level of trunk straightness (Lts): assessed by the point method and scored in 5 levels, from 1 to 5 points according to Kha, Hung 2003 (MARD, 2007; Kha. L.D., Hung. D.M., 2003), in which: thetrunk is very curved (1 point); curved trunk (2 points); quite straight trunk (3 points); straight trunk (4 points) and the trunk is very straight (5 points);

+ Level of small branch (Lsb): evaluated by the point method, and scored in 5 levels, from 1 to 5 points according to Kha, Hung, 2003 (MARD, 2007; Kha. L.D., Hung. D.M., 2003);

+ Health (Hlt): assessed by the point method, and scored in 5 levels, from 1 to 5 points according to Kha, Hung, 2003 (MARD, 2007; Kha. L.D., Hung. D.M., 2003);

+ Synthetic quality criteria (Sqc): the synthetic quality criteria evaluated as a combination of the previus criteria (Lts, Lsb, and Hlt), according to formula (2):

$$Sqc = Lts * Lsb * Hlt \quad (2);$$

Where: Lts: Level of trunk straightness; Lsb: Level of small branch and Hlt: Health.

Selection of some fast-growing and good trunk quality families:

Selection of some fast growing *E.urophylla* families was carried out by statistical analysis method and ranking on some growth norms and trunk quality criteria.

Data were analyzed with Data Plus and Genstat programs, which are widely used in forest tree breeding study. Also, they were applied with biological statistics in forestry in Excel program.

III. RESULTS AND DISCUSSION

3.1. Growth of E. urophylla families of the seed orchards

Survival rate (SR)

The survival rate of *E. urophylla* families of the seed orchards is one of the key criteria that reflects the viability of each tree of a family. In this study, the survival rate of *E. urophylla* families (data collection time) of the seed orchards (SO) is summarized in Table 1.

Table 1. Survival rate of 60 E. *urophylla* families of the seed orchards

Families	SR (%)	Rank	Families	SR (%)	Rank
35	**100.0**	**1**	**94**	**75.0**	**31**
20	91.7	2	101	75.0	32
...	..	..	..	..	...
31	87.5	5	13	70.8	35
90	87.5	6	16	70.8	36
92	87.5	7	19	70.8	37
...	...	...	...	...	...
98	83.3	15	100	70.8	45
4	79.2	16	951	70.8	46
34	79.2	17	971	70.8	47
47	79.2	18	991	70.8	48
49	79.2	19	18	66.7	49
96	79.2	20	27	66.7	50
981	79.2	21	33	66.7	51
...	...	..	...	..	..
15	75.0	26	29	62.5	56
23	75.0	27	32	62.5	57
36	75.0	28	45	62.5	58
37	75.0	29	89	62.5	59
50	**75.0**	**30**	**24**	**54.2**	**60**
			Ft (1.80) < $F_{0.5}$ (3.92)		
Average of SO			**74.9**		

Table 1 shows that, the survival rates of *E. urophylla* families in the 2.5 year old stage are ranged from 54.2% (family No. 24) to 100% (family No.35). Accordingly, families above average survival rates overpass the average of the seed orchards (74.9%) and survival rate over 80% attained 53.3% and 25% respectively. Thus, most of *E. urophylla* families a survival rate have above the average of the seed orchards.

Result of statistics tests shows that, thevalue of Ft (1.80) < $F_{0.5}$ (3.92) so difference of the survival rate between families at the seed orchard was not significant.

In other words, the effect of genetics factor on the survival rate of *E. urophylla* families of the seed orchards is not clear, so further monitoring is needed to obtain more accurate results.

However, a significant fluctuation in the survival rate of 60 families in the seed orchards was the premise that allowed the selection of some families with higher survival rates compared to other families of the seed orchards. On the other hand, absence of family with 100% rate of dead trees has shown that, the ability to adapt and survive with environmental conditions in the seed orchards

is great, and facilitating of the construction of the seed orchards was successfull.

Growth in diameter, height and trunk volume with bark

Survival rate is a necessary condition, but not sufficient. It is important that the number of selected tree in the families at the seed orchards to grow fast and has good trunk quality to meet the breeder's goal.

In this study, some growth norms of 60 *E.urophylla* families of the seed orchards are summarized in Table 2.

Table 2. Growth of 60 *E. urophylla* families of the seed orchards

Families	$D_{1.3}$ (cm)		H_{full} (m)		V (dm^3)	
	$\bar{X}$	CV%	$\bar{X}$	CV%	$\bar{X}$	CV%
2	7.4	24.8	8.1	18.1	17.4	5.1
3	7.7	26.5	8.5	16.4	19.8	14.0
4	6.9	28.3	**7.3**	20.8	13.6	5.3
5	6.7	38.3	7.5	23.9	13.2	8.3
..	…	…	…	…	..	…
11	6.6	33.7	7.6	24.8	13.0	10.9
12	7.3	32.6	**7.0**	30.2	14.6	5.2
13	7.6	26.9	7.5	13.8	17.0	8.0
14	7.7	28.4	7.8	22.1	18.2	6.1
15	7.8	32.0	8.1	19.4	19.4	7.1
..	…	…	…	…	..	…
93	**8.9**	24.3	**8.8**	14.8	**27.4**	12.5
94	7.4	32.7	8.0	16.9	17.2	5.4
95	7.4	25.7	7.5	16.4	16.1	9.1
96	**6.4**	28.9	7.7	23.2	**12.4**	7.7
97	7.2	32.7	7.2	23.0	14.7	10.1
98	7.1	23.9	8.0	22.0	15.8	5.8
99	7.1	33.0	7.5	21.8	14.8	14.3
...	..	..	..	..	..	..
961	8.0	25.5	7.9	18.2	19.9	11.7
971	7.2	22.4	7.4	14.4	15.1	7.1
981	7.5	16.0	7.4	13.0	16.3	10.4
991	7.4	32.2	7.5	22.2	16.1	20.5
	Ft (11.2) > $F_{0.5}$ (3.9)		Ft (11.1) > $F_{0.5}$ (3.9)		Ft (9.4) > $F_{0.5}$ (3.9)	
Average SO	**7.4**		**7.7**		**16.9**	

Table 2 shows that, the average diameter for the whole of seed orchards is 7.4 cm, the average growth rate for diameter is 2.97 cm/year. Thus, the growth in diameter of the seed orchards families is quite quick.

However, there is a significant disparity between families, such as the diameter of 8.9 cm of the fastest growing family (No. 93), which exceed 1.4 times the level than of the slowest family (No. 35) for the same comparison norms.

It is noteworthy that there are 34 families whose growth in diameter exceeding level of the average diameter for the whole of seed orchards (7.4 cm), reached rate 56.67%. In addition, the data in Table 2 also shows that the coefficients of variation of diameter were value high.

Similarly, the average height growth of the seed orchards is 7.79 meters, with the average annual growth rate of 3.11 meters, and the number of families whose average height exceeded for the whole of seed orchards reached 46.67%. However, there is a difference of height between the families, such as family (No. 93) with the highest height exceeds family (No. 12) with the lowest height 1.3 times.

Similarly to the above analysis, the average growth of trunk volume in the whole of seed orchards was 16.9 dm^3/tree, so the average of trunk volume of growth speed was 6.79 dm^3 per tree per year, families whose rate of the average growth of trunk volume exceeded the average of the seed orchards are 50.0%. However, there is a difference of trunk volume between the families, such as the family (No. 93) with the largest trunk volumewhich exceedsthe trunk volume of the family (No. 35) with the smallest trunk volume 2.3 times.

Thus, *E. urophylla* at the seed orchards began to have a significant differentiation of diameter. The results of statistical tests show that, all three growth norms include ($D_{1.3}$, H_{full} and V) the value of Ft (11.2; 11.2 and 9.4) > $F_{0.5}$ (3.9), and growth of diameter, height and trunk volume between families. So tending of all trees of seed orchards in order to develop trunk diameter needs strong attention.

In summary, the results of the analysis allow for a preliminary to remark that, under stable environmental conditions as the seed orchards, the difference in growth between families is caused more by genetics influence or control than by the environment factors. This is an important base of choosing families with good genotypes, as well as eliminating genotype that do not meet the goal.

In this study, for early selecting fast-growing families, or those with a lot of ability, which have good genotypes, the rankings of family for fassr growth was created based on research in Table 3.

Table 3. Rankings of family for fast-growing of the seed orchards

Families	$D_{1.3}$ (cm)		H_{full} (m)		V (dm^3)		Families	$D_{1.3}$ (cm)		H_{full} (m)		V (dm^3)	
	$\bar{X}$	Rank	$\bar{X}$	rank	$\bar{X}$	rank		$\bar{X}$	rank	$\bar{X}$	rank	$\bar{X}$	rank
93	8.9	1	8.8	1	27.4	1	**27**	7.4	33	8.3	9	17.8	31
34	8.8	2	8.4	6	25.5	2	**10**	7.3	35	8.1	14	17.0	32
45	8.6	3	8.7	2	25.3	3	**36**	7.3	36	7.9	26	16.5	33
31	7.9	8	8.6	4	21.1	5	**95**	7.4	32	7.5	41	16.1	35
90	8.0	5	8.1	15	20.4	6	**991**	7.4	34	7.5	46	16.1	36
..	..	..	..	..	..	..	**..**	..	..	..		..	..
15	7.8	11	8.1	16	19.4	12	**971**	7.2	43	7.4	49	15.1	42
24	8.0	6	7.6	35	19.1	13	**100**	7.1	47	7.6	33	15.0	43
92	7.6	20	8.3	8	18.8	15	**42**	7.0	49	7.7	31	14.8	45
..	..	..	..	..	..	..	**..**	..	..	..	..	..	.
30	7.6	19	8.0	20	18.1	20	**50**	7.0	48	7.3	54	14.0	50
89	7.5	27	8.2	12	18.1	21	**25**	6.8	53	7.6	34	13.8	51
94	7.4	28	8.0	19	17.2	26	**29**	6.5	58	7.6	36	12.6	56
..	..	..	.	..	..	..	**..**	..	..	..	..	..	..
46	7.7	14	7.3	51	17.0	28	**96**	6.4	59	7.7	30	12.4	58
981	7.5	26	7.4	48	16.3	29	**88**	6.6	55	7.2	58	12.3	59
16	7.4	30	7.5	42	16.1	30	**35**	6.4	60	7.5	45	12.1	60

Table 3 shows that, families with a high ranking for diameter growth also have a high ranking for height and trunk volume growth. For example, families No. 93, 34, 45, 31, and No. 90 have high ranking for diameter growth, which are: 1st, 2nd, 3rd, 8th and 5th, also reached high ranking for height, and also reached high rankings for trunk volume, which are 6th, 2nd, 4th and 15th, and 1st, 2nd, 3rd,5th, and 6th respectively.

While for other families, such as families No. 96, 88, and No. 35, with only low growth rankings for diameter growth of 59th, 55th and 60th, also have low growth rankings in height and trunk volume of 30th, 58th, and 45th; and 58th, 59th and 60th respectively, under the same environmental conditions. This demonstrate that the division of familiess due to growth is controlled rather by genetic factor than by environmental factors.

3.2. The quality of the trunk of the *E. urophylla* family of the seed orchards

In this study, the quality of stems in each family and in the whole of seed orchards was assessed and summarized in Table 4.

Table 4. Quality of the trunk at the seed orchards of E.urophylla families

Families	Criteria quality of the trunk (point)			
	(Lst)	(Lsb)	(Hlt)	(Sqc)
6	3.0	2.8	3.0	25.2
7	3.1	2.9	2.9	26.1
11	2.7	2.5	2.8	18.9
..	..	..	..	..
15	3.2	3.0	3.2	30.7
31	3.0	3.0	3.1	27.9
34	3.1	3.1	3.1	29.8
..	..	..	..	..
45	3.0	3.1	3.2	29.8
92	3.1	3.0	3.1	28.8
93	3.1	3.1	3.2	30.8
...	...	...	..	..
97	3.1	3.0	3.0	27.9
98	3.1	2.9	3.1	27.9
99	2.8	2.9	2.9	23.5
..	..	..	..	..
971	2.8	3.1	3.0	26.0
981	2.8	3.1	3.1	26.9
991	3.1	3.1	3.0	28.8
Average SO	**3.0**	**2.9**	**3.0**	**26.2**

Table 4 shows that the trunk quality according to single criteria did not differ significantly among the families as compared to the average of the whole of seed orchards. However, the synthetic quality criteria (Sqc) need attention. Accordingly, the family (No. 93) had the highest Sqc reaching 30.8 exceeding 1.62 times the level of the family (No. 11) with the lowest Sqc.

Thus, in families not only have difference for growth but also quite clearly show the quality of the trunk. However, to allow the selection of families to meet the target, the quality rating is very necessary. In this study, the trunk quality rankings are summarized in Table 5.

Table 5. Quality ranking of trunks according to *E. urophylla* families

Families	Criteria quality of the trunk (point)						Families	Criteria quality of the trunk (point)					
	(Lst)		(Lsb)		(Hlt)			(Lst)		(Lsb)		(Hlt)	
	$\bar{X}$	rank	$\bar{X}$	rank	$\bar{X}$	rank		$\bar{X}$	rank	$\bar{X}$	rank	$\bar{X}$	rank
15	3.2	1	3.0	18	3.2	1	**101**	3.0	31	2.9	38	3.1	16
92	3.1	2	3.0	19	3.1	8	**90**	3.0	32	2.9	39	3.0	30
..	..	..	..	..	..	..	**..**	..	..	..	..	..	..
93	3.1	6	3.1	3	3.2	2	**37**	2.9	36	2.8	51	2.7	59
40	3.1	7	2.9	29	3.1	10	**5**	2.9	37	3.1	12	3.0	32
34	3.1	9	3.1	4	3.1	11	**30**	2.9	39	3.0	26	2.9	45
..	..	..	..	..	..	..	**..**	..	..	..	..	..	..
98	3.1	16	2.9	34	3.1	13	**43**	2.9	46	2.9	43	3.1	18
31	3.0	17	3.0	24	3.1	14	**88**	2.9	47	2.8	53	2.8	52
10	3.0	19	3.0	25	2.9	40	**26**	2.9	49	2.9	44	2.8	53
..	..	..	..	..	..	..	**..**	..	..	..	..	..	..
45	3.0	25	3.1	9	3.2	5	**14**	2.8	55	2.8	57	2.8	55
46	3.0	26	3.1	10	3.2	6	**971**	2.8	56	3.1	16	3.0	35
48	3.0	27	2.8	48	3.0	27	**21**	2.8	57	3.1	17	3.0	36
94	3.0	30	2.9	37	2.9	43	**11**	2.7	60	2.5	60	2.8	57

Data in Table 5 shows that, families with high points for level of trunk straightness (Lst), also often have a high points for level of small branch (Lsb), and health (Hlt).

For example, families No. 15; 92; 93; 40; and No. 34 had ranking for quality with following level of trunk straightness (Lst): 1st, 2nd , 6th, 7th and 9th ; the rank of level of small branch (Lsb), and health is 18th, 19th, 3th, 29th, and 4th; and with 1st, 8nd; 2th, 10th and 11th for the same comparative criteria.

Thus, families with high ranking for growth and trunk quality should be priority in early selection.

3.3. Early selecting with fast-growth families with good trunk quality exceeding level 10% of the whole of seed orchards

Table 6. Growth ranking of the 13 best families of growth

Families	$D_{1.3}$ (cm)		H_{full} (m)		V (dm^3)	
	$\bar{X}$	Exceeding level (%)	$\bar{X}$	Exceeding level (%)	$\bar{X}$	Exceeding level (%)
93	8.90	20.1	8.8	13.0	27.4	**61.5**
34	8.80	18.8	8.4	7.8	25.5	50.3
45	8.60	16.1	8.7	11.7	25.3	**49.1**
49	8.20	10.7	8.3	6.5	21.9	29.1
31	7.90	6.6	8.6	10.4	21.1	24.3
90	8.00	8.0	8.1	4.0	20.4	**20.2**
951	7.80	5.3	8.3	6.5	19.8	16.7
47	7.60	2.6	8.7	11.7	19.7	16.1
3	7.70	3.9	8.5	9.1	19.8	16.7
961	8.00	8.0	7.9	1.4	19.9	17.3
19	7.80	5.3	8.2	5.3	19.6	15.5
15	7.80	5.3	8.1	4.0	19.4	14.3
92	7.60	2.6	8.3	6.5	18.8	**10.8**

As mentioned above, families in the seed orchards have a fast growth rate and good trunk quality, and these families will have priority in early selection.

In this study, fast growth families with the best quality and with high rankings exceeding level of 10% ccompare to average value for growth and trunk quality criteria of the whole seed orchards will be priority for early selection are summarized in Table 6.

Data in Table 6 show that, from the 60 *E. urophylla* families in the seed orchards, 13 chosen of them had level of diameter, height and trunk volume exceeding 10% compare to the average for the whole of seed orchards, reached about 21.66%.

Accordingly, the family (No. 93) had the highest trunk volume, in comparision exceeding 61.5% level of the family (No. 92), which had the lowerest trunk volume, lower 5.7 times.

However, if getting a trunk volume exceeding level 20% in comparision to the whole of seed orchards is criteria for selection, only 6 out of 13 families, including family No. 93, 34, 45, 49, 31, and No. 90 can be selected (Table 6).

Normal growth speed usually depends on genetics, environmental conditions and the stage of individual development. Thus, the above results may allow to remark that fast growth families in initial will be for breeding in the next study. For example, early selecting studies or clonal testing, are the base of clonal plantation from fast-growing families. As mentioned above, the objective of the study is to select from families those with fast growth and good trunk quality.

In this study, trunk quality was ranked in the upper part, compared to the average of the whole seed orchards. Accordingly, familieson the trunk quality criteria, which had the synthetic quality criteria (Sqc) exceeded level 10% compared to average of the whole of seed orchards are recorded in Table 7.

Table 7. Quality of the trunk ranked of the 10 best families

Families	Lst (point)		Lsb (point)		Hlt (point)		Sqc(point)	
	$\bar{X}$	Exceeding level (%)	$\bar{X}$	Exceeding level (%)	$\bar{X}$	Exceeding level (%)	$\bar{X}$	Exceeding level (%)
15	3.2	7.74	3.0	1.69	3.2	7.02	32.8	**25.1**
92	3.1	4.38	3.0	1.69	3.1	3.68	30.8	17.4
32	3.1	4.38	3.0	1.69	3.1	3.68	30.8	17.4
93	3.1	4.38	3.1	5.08	3.2	7.02	30.8	17.4
95	3.1	4.38	3.1	5.08	3.0	0.33	30.8	17.4
33	3.1	4.38	3.0	1.69	3.0	0.33	30.8	17.4
34	3.1	4.38	3.1	5.08	3.1	3.68	29.8	13.7
97	3.1	4.38	3.0	1.69	3.0	0.33	29.8	13.7
991	3.1	4.38	3.1	5.08	3.0	0.33	29.8	13.7
31	3.0	1.01	3.0	1.69	3.1	3.68	28.8	**10.1**
45	3.0	1.01	3.1	5.08	3.2	7.02	27.0	**3.1**

Data in Table 7 show that, from 60 families only 10 of them can be selected (*except family No. 45*) including: family No. 15, 92, 33, 34, 93, 95, 33, 34, 97, 991 and No. 31, that had the synthetic quality criteria exceeding level 10% compared to the average of the whole of seed

orchards in the same criteria in comparison, reaching 16.66%.

If to selecte only families, whose had both growth norms and trunk quality criteria with exceeding level 10% compared to the whole of seed orchards, they are recorded in Table 8.

Table 8. Selection of the best families of the whole of seed orchards

Families	Norms						Criteria synthetic quality of trunk (point)	
	$D_{1.3}$ (cm)		H_{full} (m)		V (dm^3)			
	$\bar{X}$	Exceeding level (%)	$\bar{X}$	Exceeding level (%)	$\bar{X}$	Exceeding level (%)	$\bar{X}$	Exceeding level (%)
93	8.90	20.1	8.8	13.0	27.4	**61.5**	30.8	**17.4**
34	8.80	18.8	8.4	7.8	25.5	50.3	29.8	13.7
45	860	16.1	8.7	11.7	25.3	**49.1**	27.0	**3.1**
31	7.90	6.6	8.6	10.4	21.1	24.3	28.8	10.1
15	7.80	5.3	8.1	4.0	19.4	14.3	32.8	25.1
92	7.60	2.6	8.3	6.5	18.8	**10.8**	30.8	**17.4**

Data in Table 8 and Figure 1 showed that, among the 18 families selected with fast growth and good quality trunk (Table 6 and Table 7), only 6 families can be selected [except family No. 45 that level of the quality of synthesis (Sqc) is low, but exceeded level of trunk volume (V) is very high, Table 8], reaching rate 10% of the total 60 families of the whole of the seed orchards.

In addition, the values of the histogram and line showed in Figure 1 (left) and foto of family No. 34 (right) show that, exceeding level for trunk volume tends to decrease from family No. 93 to family No. 92.

In summary, from the above results, it is possible to make preliminary observation that the seed orchards may initially allow the early selection of 6 families, including family No. 93; 34; 45; 31; 15 and family No. 92 which have both fast growth and the best trunk quality in the whole of seed orchards.

However, this is just the preliminary results because the seed orchards, should be monitored and evaluated at later stages for more accurate results.

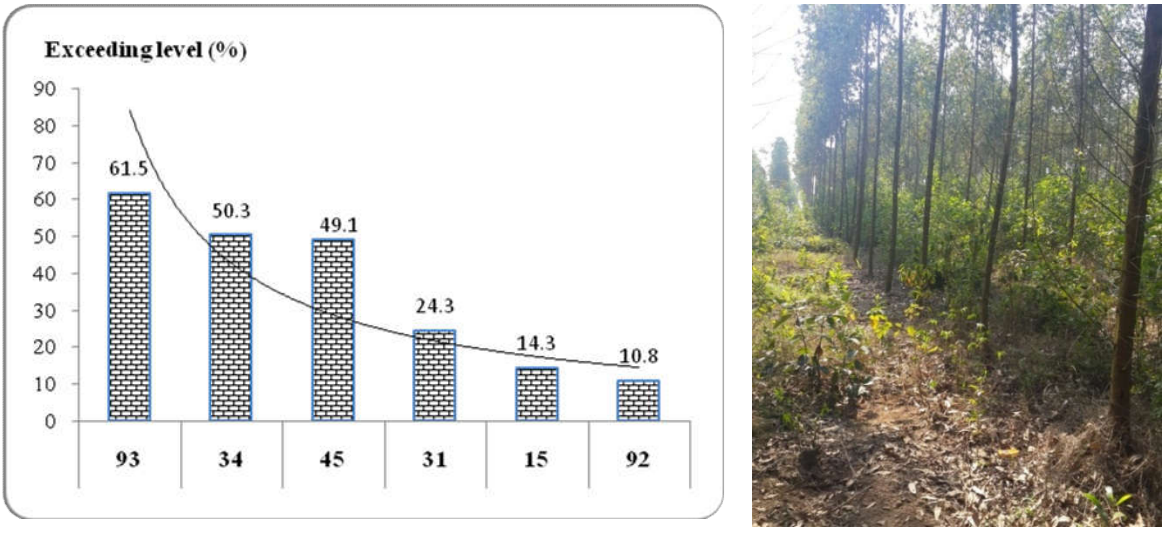

Figure 1. The best families of both growth and trunk quality (left) and image trunk form of family No. 34 (right) of the *E. urophylla* seed orchards

The results of this study can allow to conduct studies on clonal trials from selected families as well as to make phenotype and genotype thinning trials for families that had slow growth and poor trunk quality in the seed orchards.

IV. CONCLUSION

From the results of the research above can be concluded as follows:

1. The average survival rate of 60 *Eucalyptus urophylla* families was 74.9%, according to the numbers of families whose survival rate are higher than the average of the whole seed orchards reaching 53.3%.

2. The average growth, and the annual growth rate for diameter, height and trunk volume of 60 families were 7.40 cm; 7.79 m, and 16.9 dm^3; and 2.97 cm; 3.11 m, and 6.79 dm^3 respectively.

3. There is a significant difference in height and trunk volume between families, in which, the family (No. 93) has the greatest value in height and trunk volume, higher than family (No. 12) with the smallest height (higher 1.3 times), and the family (No. 35) with the smallest trunk volumes (higher 2.3 times).

4. The quality of the trunk according to single criteria does not differ between families; meanwhile the quality of synthesis (Sqc) is opposite, the family (No. 93) with the highest quality of synthesis (Sqc) which is 30.8; higher 1.62 times than the family (No. 11) with the lowest quality of synthesis (Sqc) in the same time and condition.

5. Among the 60 families of the seed orchards, only 13 of them were selectedwith fast growth norms ($D_{1.3}$, H_{full} and V), and 10 other families whose the quality of synthesis (Sqc) exceeds level 10% of the whole of seed orchards, reached 21.6% and 16.6% respectively.

6. Out of 60 families only 6 of them can be chosen including: family No. 93, 34, 45, 31, 15 and family No. 92, exceeding level 10% for both growth norms and the quality of synthesis criteria compared to the whole of seed orchards.

7. This study is the initial result and the seed orchards being needs to have time to follow and evaluate to get more accurate results.

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NGHIÊN CỨU CHỌN LỌC SỚM MỘT SỐ GIA ĐÌNH BẠCH ĐÀN (*EUCALYPTUS UROPHYLLA*) SINH TRƯỞNG NHANH, CHẤT LƯỢNG THÂN CÂY TỐT Ở VƯỜN GIỐNG TẠI BA VÌ, HÀ NỘI

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TÓM TẮT

Nghiên cứu chọn lọc sớm một số gia đình Bạch đàn urô sinh trưởng nhanh, chất lượng thân cây tốt ở vườn giống tại Ba Vì, Hà Nội cho thấy, tỷ lệ sống trung bình của 60 gia đình là 74,9%, trong đó số gia đình có tỷ lệ sống trên mức trung bình toàn vườn chiếm tỷ lệ 53,3%. Sinh trưởng trung bình và tốc độ sinh trưởng bình quân năm về đường kính, chiều cao và thể tích của 60 gia đình đạt trị số là 7,40 cm; 7,79 m, và 16,9 dm^3; và 2,97 cm; 3,11 m, và 6,79 dm^3 tương ứng. Có sự khác biệt đáng kể về chiều cao và thể tích giữa các gia đình, trong đó gia đình số 93 có giá trị lớn nhất về chiều cao và thể tích vượt hơn gia đình số 12 có chiều cao nhỏ nhất, và vượt gia đình số 35 có thân cây nhỏ nhất là 1,3 lần và 2,3 lần tương ứng. Chất lượng thân cây theo chỉ tiêu đơn lẻ không có sự khác biệt lớn giữa các gia đình, trong khi chỉ tiêu chất lượng tổng hợp (Sqc) thì ngược lại, gia đình số 93 có Sqc cao nhất (30,8) vượt gia đình số 11 có chỉ số Sqc nhỏ nhất là 1,62 lần trong cùng thời gian và điều kiện. Trong số 60 gia đình tại vườn giống, có thể chọn được 13 gia đình có các chỉ tiêu sinh trưởng ($D_{1.3}$; Hvn và V), 10 gia đình có chỉ tiêu chất lượng tổng hợp (Sqc) có độ vượt trên 10% so với toàn vườn giống, chiếm tỷ lệ là 21,6% và 16,6% tương ứng. Từ 60 gia đình chỉ có thể chọn được 6 trong số chúng gồm: gia đình số 93; 34; 45; 31; 15; và số 92, có độ vượt trên 10% cả về sinh trưởng và chất lượng tổng hợp, chiếm tỷ lệ là 10% so với toàn vườn giống. Kết quả nghiên cứu này là cơ sở cho đề xuất chọn lọc sớm một số gia đình có sinh trưởng nhanh và chất lượng thân cây tốt, cũng như tỉa thưa các gia đình chất lượng thấp và sinh trưởng kém.

Từ khóa: Bạch đàn uro, chọn lọc giống, sinh trưởng, vườn giống bạch đàn.

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