NURSERY PERFORMANCE OF EXOTIC POPLARS UNDER MID-HILL CONDITIONS OF HIMACHAL PRADESH

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Introduction

Poplars occupy a unique and important position in the rural economy of North India. They are known for their fast growth, easy vegetative propagation, capability to enrich surface soil by adding leaf litter and the ability to provide substantial production (10 to 30 m^3/ha/yr) on a short rotation of 6 to 12 years (Tewari, 1993). The role of Poplars in improving forest productivity and meeting the requirements of various wood based industries for raw materials, need no emphasis. However, the yield is substantially reduced, both in quantity and quality by multitude of insects that feed on it (Verma *et al.*, 1982). Straightness of stem, susceptibility to shoot borer, branchiness and height-diameter growth with respect to different diameter classes of cuttings and spacings have also been studied at nursery stage (Chaukiyal and Sharma, 1985; Chaukiyal *et al.*, 1987). Poplars offer great scope in improving overall forest productivity and meeting the growing needs of various wood based industries besides providing extra income to farmers. As a result, it has gained the central position in agroforestry practices because of its fast growth and manifold uses.

The success of some of the exotic clones of poplars like IC and I-488 led to more clonal trials and clones like G3, G48 and D121, became quite popular with the Forest Department and the farmers of Northern India. It is possible that we might run down present commercial clones due to disease susceptibility and poor performance. Heybroek (1978), Sidhu (1989), and Singh and Singh (1986) also agree to the fact that a few clones of Poplar are progressively becoming susceptible to many insect pests and pathogens. Chaturvedi (1981) has also suggested that some clones, which were considered promising in the past are no longer considered so. In order to tap greater potential of poplars and to find replacement for today's clones there is a need to intensify the clonal trials and introduce newer clones in agroforestry system. Various workers have tested Poplar clones in nursery in different climatic zones in India (Dhanda, 1983; Deshraj and Cheema, 1990; Jamwal, 1979; Lohani, 1976; Seth, 1969; Sidhu, 1989; Thangam, 1979). This resulted in introduction of more and more exotic clones of *Populus deltoides* to select high yielding clones for different zones. Also in order to maintain genetic diversity to ensure against epidemic outbreaks of pests and diseases it has been suggested that 5 to 10 per cent of

the existing clones should be replaced by superior ones every year (Zsuffa, 1983). Evaluation of other lesser-known clones of poplars therefore, needs to be done. This can be done by assessing the performance of these clones both at the nursery and field levels. One such attempt has been made through this study to introduce some exotic Poplar clones in mid-hills (800-1600 m) of Himachal Pradesh by evaluating their growth performance under nursery conditions.

Material and Methods

The present investigation was carried out at Research Nursery, Shilly of Himalayan Forest Research Institute, Shimla situated at 31°N and 77°E in reserved forest of Solan Division on northern aspect at an altitude of 1500 m (asl). The nursery falls under the temperate climate. Summers are moderately hot and winters are very severe. Second fortnight of November to January are marked by severe frost and the average rainfall ranges from 100 to 130 cm.

The material for the present study comprised of 63 clones of *Populus deltoides* and 5 clones of *Populus* x *euramericana*. These were planted in Randomised Block Design with 25 cuttings per clone in three replications at a spacing of 30 x 50 cm in sunken beds of size 230 x 150 cm under the usual nursery conditions in year 1997. Shoot cuttings used for planting were 22.50 cm long and of more than 1 cm in thickness. Soil was firmly pressed around cuttings with the help of thumb to ensure that plant material has come in contact of mineral soil. Insertion of cuttings was followed by flood irrigation. The experiment was regularly watered and weeding and hoeing were done whenever necessary. Sprouting of each clone was noted daily till its completion. Survival and growth data (collar diameter and height) were observed on monthly intervals. The data for growth parameters was recorded and subjected to statistical analysis. Growth trend of best performer clones has been calculated on the basis of growth attained in height and collar diameter during summer, monsoon and autumn seasons.

Results and Discussion

(a) *Sprouting percentage* : The data on sprouting and survival percentage of cuttings is given in Table 1. Sprouting percentage was maximum (100%) for clones 29, 6399, WSL-29 and D20-54, followed by 98.67 per cent recorded by the clones L-293/84, D21, L-181/84, L-51/84, 3201, A-324, G48, L-52-82, 110702 and 73/53.2. The clone 3651 showed the lowest sprouting percentage of 72.

(b) *Survival percentage* : Of the 68 clones tried in the experiment clone-29 was found to have 100 per cent survival followed by clones D21, 3201 and L-75/84 recording 98.67 per cent survival. A survival per cent of 97.33 was recorded for clones L-51/84 and PS-708 whereas, clones L-181/84, 6399, *P.* x *euramericana* I-214, 3204 and *P.* x *euramericana* 72/58 showed 96.00 per cent survival. The clone 3651 was found to have the lowest survival percentage of 61.33 at the completion of experiment.

(c) *Height* : It is evident from Table 1 that the clone ST-72 recorded maximum height growth of 233.33 cm followed by L-71/84 (225.63 cm), *P.* x *euramericana* (218.18 cm), L-181/84 (212.1 cm) and L-52/82 (207.63 cm). The clone 73/53.7(95) showed the poorest height growth (112.93 cm) at the end of one year.

Table 1

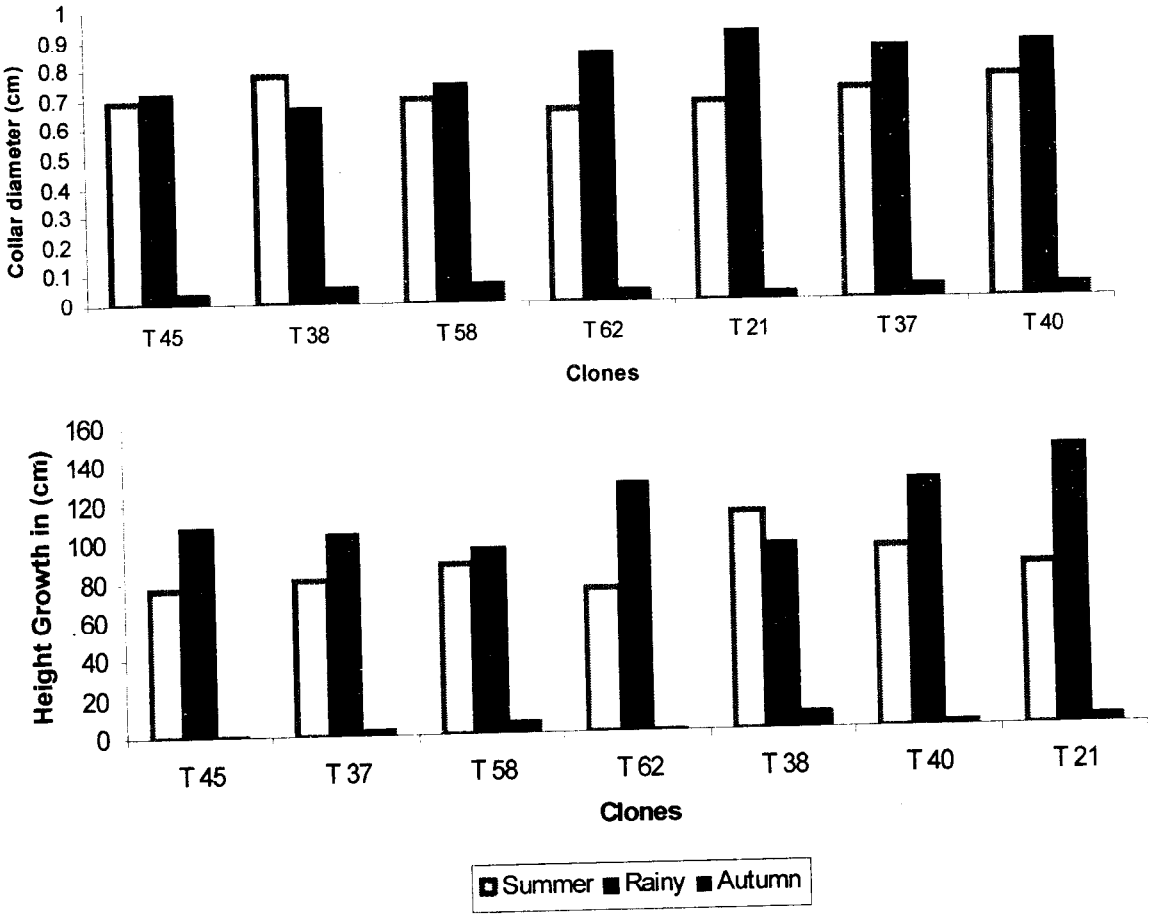
Geographical origin, sprouting, survival per cent, height and collar diameter of different clones during January

Treatment	Clone	Geographical Origin/Place of Development	Sprouting (%)	Survival (%)	Height (cm)	Collar dia. (cm)
1	2	3	4	5	6	7
T_1	64-243-1	Missouri (USA)	96.00	90.67	181.58	1.34
T_2	2504	Mississippi (USA)	94.67	90.67	170.30	1.47
T_3	2503	Mississippi (USA)	85.33	80.00	125.10	1.06
T_4	29	USA	100.00	100.00	174.50	1.31
T_5	*P.* x *euramericana*					
	45/51	USA	93.33	84.00	162.37	1.44
T_6	61	USA	96.00	88.00	114.77	0.99
T_7	153	USA	90.67	86.67	146.50	1.25
T_8	CL-043	Stoneville, Mississippi (USA)	86.67	76.00	116.07	0.98
T_9	L-293/84	Developed at Lalkuan (India)	98.67	88.00	115.33	1.00
T_{10}	L-165/84	Developed at Lalkuan (India)	94.67	92.00	144.17	1.31
T_{11}	D121	USA	97.33	94.67	150.80	1.32
T_{12}	3650	Louisiana (USA)	86.67	88.00	146.10	1.30
T_{13}	2/56	Germany	97.33	94.67	155.17	1.30
T_{14}	D21	USA	98.67	98.67	123.53	0.99
T_{15}	L-181/84	Developed at Lalkuan (India)	98.67	96.00	212.10	1.48
T_{16}	WSL-9	Developed at Rudrapur (India)	86.67	86.67	129.33	1.20
T_{17}	L-51/84	Developed at Lalkuan (India)	98.67	97.33	180.00	1.42
T_{18}	L-29/82	Developed at Lalkuan (India)	94.67	86.67	123.53	1.01
T_{19}	G3	Brazos, Texas (USA)	93.33	92.00	165.10	1.32
T_{20}	3201	Nebraska (USA)	98.67	98.67	141.53	1.20
T_{21}	ST-72	Stoneville, Mississippi (USA)	86.67	81.33	233.33	1.63
T_{22}	TR1T10	—	97.33	93.33	161.30	1.39
T_{23}	1/56	W. Germany	93.33	90.67	156.23	1.37
T_{24}	A-37 (1001)	Alabama, Clarke county (USA)	90.67	93.33	160.43	1.46
T_{25}	D2094 (1018)	Missouri, USA	94.67	88.00	172.53	1.34
T_{26}	A-324	Illinois (USA)	98.67	93.33	178.43	1.49
T_{27}	ST-82	Stoneville, Mississippi (USA)	89.33	84.00	128.97	1.14
T_{28}	*P.* x *euramericana*					
	LUX 69/55	USA	97.33	94.67	159.43	1.26
T_{29}	I-18/62	Italy	97.33	92.00	149.25	1.33
T_{30}	D424 (1021)	Germany (W. Virginia)	86.67	73.33	131.60	1.05
T_{31}	G48	Brazos, Texas (Australia)	98.67	92.00	185.57	1.44

Contd...

1	2	3	4	5	6	7
T_{32}	3252	Nebraska (USA)	90.67	82.67	148.30	1.12
T_{33}	6399	Illinois nr. 2	100.00	96.00	116.60	1.14
T_{34}	3278	Nebraska (USA)	97.33	93.33	150.57	1.12
T_{35}	2498	Mississippi (USA)	96.00	82.67	145.00	1.09
T_{36}	ST-67	Stoneville, Mississippi (USA)	89.33	89.33	158.77	1.16
T_{37}	181	USA	85.33	90.33	187.27	1.63
T_{38}	*P.* x *euramericana*	U.K.	96.00	93.33	218.18	1.51
T_{39}	3686	Kansas	94.67	94.67	154.20	1.45
T_{40}	L71/84	Developed at Lalkuan (India)	90.67	90.67	225.63	1.69
T_{41}	PS-708	Stoneville, Mississippi (USA)	97.37	97.33	204.40	1.56
T_{42}	3651	Mississippi (USA)	72.00	61.33	146.97	1.17
T_{43}	6402	Illinois nr. 5	88.00	88.00	134.43	1.20
T_{44}	WSL-17	Developed at Rudrapur (India)	90.67	85.33	162.70	1.30
T_{45}	L-200/84	Developed at Lalkuan (India)	96.00	94.67	185.50	1.45
T_{46}	82-33-3	Texas	86.67	90.67	128.77	1.20
T_{47}	L-52/82	Developed at Lalkuan (India)	98.67	92.00	207.63	1.36
T_{48}	A-26 (75)	Alabama	84.00	82.67	197.47	1.62
T_{49}	WSL-29	Developed at Rudrapur (India)	100.00	82.67	156.47	1.16
T_{50}	S7C1	Stoneville, Mississippi (USA)	93.33	92.00	193.70	1.40
T_{51}	6328	Illinois nr. 12	93.33	82.67	118.40	1.04
T_{52}	73/53.7 (95)	Illinois (USA)	82.67	74.67	112.93	1.04
T_{53}	*P.* x *euramericana*					
	I-214	Italy	97.33	96.00	163.20	1.49
T_{54}	3298	Nebraska (USA)	97.33	90.67	131.43	1.15
T_{55}	73/53.3 (94)	Illinois (USA)	90.67	90.67	159.00	1.17
T_{56}	ST-109	Stoneville, Mississippi (USA)	90.67	86.67	186.03	1.37
T_{57}	3294	Nebraska (USA)	93.33	96.00	150.40	1.25
T_{58}	110702	Mississippi (USA)	98.67	94.67	190.13	1.52
T_{59}	73/53.2	Illinois (USA)	98.67	94.67	150.77	1.18
T_{60}	2656	Tennessee (USA)	90.67	93.33	162.47	1.36
T_{61}	A-14(1016)	Alabama	84.00	84.00	178.90	1.46
T_{62}	L-75/84	Developed at Lalkuan (India)	96.00	98.67	203.90	1.55
T_{63}	A-26	Alabama, Clarke county (USA)	93.33	90.67	177.33	1.49
T_{64}	3567	Florida (USA)	84.00	86.67	149.40	1.29
T_{65}	WSL-36	Developed at Rudrapur (India)	88.00	72.00	140.67	1.04
T_{66}	D20-54	Missouri	100.00	94.67	155.47	1.28
T_{67}	*P.* x *euramericana*					
	72/58	USA	93.33	96.00	140.50	1.10
T_{68}	65/27	Australia (Canberra)	86.67	88.00	122.27	1.06
		SE ±	3.80	7.24	2.40	0.15
		CD at 5%	7.45	14.19	4.70	0.30

Fig. 1



Height and collar diameter growth trends of the best performer clones in different seasons

(d) *Collar diameter* : Data recorded in the last quarter showed that L-71/84 recorded maximum diameter growth of 1.69 cm followed by 181 and ST-72 (1.63 cm). The clones CL-043, D21 and 61 recorded the lowest values of 0.98 cm each for diameter growth.

Analysis of variance have shown that clones under study differ significantly among themselves for both height and dia.

On the basis of studies conducted by Gera *et al.* (1994) a criteria for each studied parameter was fixed to judge the relative performance of different clones on the basis of sprouting and survival percentage, height and collar diameter at nursery stage. The clones with more than 85% sprouting after one month, 90% survival, 185 cm height and 1.45 cm collar diameter after one year in nursery were fixed to designate a clone to be a good performer based upon either of

these criteria. Considering these criteria collectively, clones namely 181 (T_{37}) *P.* x *euramericana* (T_{38}), L-71/84 (T_{40}), PS-708 (T_{41}), L-200/84 (T_{45}), 110702 (T_{58}) and L-75/84 (T_{62}) excelled other clones under study (Fig. 1). However, clones namely L-181/84, L-52/82, A-324, ST-72, A-26 (75) and A-14 (1016) also performed well, while considering only the growth parameters i.e., collar diameter and height. Out of the seven better performer clones, *P. deltoides* clones (six) were found to have maximum height and collar diameter growth during rainy season, whereas, the clone *P.* x *euramericana* during summers. During autumn leaf fall and dormant period start, which results in a very minimal increase in growth rate (Fig. 1). Overall good performer clones are also superior to the clones G3, G48 and D121, which have been used extensively for agroforestry practices in the past, Singh and Negi (1996) have also obtained similar results. These clones need to be tested in plantation trials for afforestation and agroforestry. Besides it the clones namely L-71/84, L-75/84, L-52/82, L-181/84 and 181, 110702, A-324, A-26 (75) are found to be most and highly resistant respectively under natural conditions to the Poplar shoot borer in nurseries at the same study site (Singh, 1999).

Although the clones like G3, G48 and D121 have been established as superior clones in Tarai areas of north India yet their worth has not been tested in mid-hill conditions of Himachal Pradesh. Further, the genetic base for the Poplar needs continuous enrichment in order to improve the further productivity. Land use pattern in mid-hills is shifting towards agroforestry practices to get maximum output per unit area. Poplar being a suitable agroforestry tree species in India requires testing and introduction under these conditions. The present study was a step towards this direction in which six clones of *P. deltoides* and one clone of *P.* x *euramericana* have been adjudged as the better performer among 68 clones on the basis of their nursery performance. They are further being tested in the field for large scale plantation programme.

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SUMMARY

In search of Poplar clones superior than present commercial ones 63 clones of *Populus deltoides* and 5 clones of *Populus* x *euramericana* were tried in nursery under mid-hill conditions of Himachal Pradesh to test their suitability. The clones namely 181, L-75/84, L-71/84, PS-708, L-200/84, 110702 and *Populus* x *euramericana* were found to be the better performers in comparison to other clones under study. Further the growth trend in different seasons show that the maximum height and collar diameter growth of all better performer clones was attained during rainy season except the *Populus* x *euramericana* clone. The field performance of the best nursery performer clones is under investigation for their commercialization and large scale incorporation into future plantation programmes of mid-hills.

हिमाचल प्रदेश के मध्य पहाड़ी क्षेत्र में परदेशीय पोपलरों की रोपणी में क्रियाशीलता

विजेन्द्र पी० पंवार व राजेश शर्मा

सारांश

वर्तमान व्यापारिक कृन्तकों की तुलना कहीं अधिक श्रेष्ठतर पोपलर कृन्तकों की खोज में *पोपुलस डेल्टायडिस* के 63 कृन्तक तथा *पोपुलस x यूरामेरिकाना* के 5 कृन्तकों को उनकी उपयुक्तता ज्ञात करने के लिए उन्हें हिमाचल प्रदेश के मध्य पहाड़ी क्षेत्र में परीक्षित करके देखा गया । अधीत किए अन्य कृन्तकों की तुलना में रोपणी में परीक्षित एल-75/84, एल-71/84, 181, पीएस-708, एल-200/84, 110702 और *पोपुलस x यूरामेरिकाना* अधिक अच्छी सक्रियता देने वाले रहे । इसके अतिरिक्त, विभिन्न मौसमों में वृद्धि होने की प्रवृति से पता चला कि सभी श्रेष्ठतर सक्रियता वाले कृन्तकों को अधिकतम ऊंचाई और मूलसंधि पर व्यास वृद्धि वर्षाऋतु में प्राप्त हुई सिवाए *पोपुलस x युरामेरिकाना* कृन्तक के । सर्वोत्तम रोपणी सक्रियतों को उनके व्यापारीकरण और मध्य पहाड़ी क्षेत्रों में भविष्य के रोपवन कार्यक्रमों में बड़े परिमाण पर सम्मिलित करने के लिए उनकी क्षेत्र सक्रियता जानने के अन्वेषण किए जा रहे हैं ।

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