

GENOTYPES OF *POPULUS* AND THEIR EVALUATION IN TERAI REGION OF UTTAR PRADESH

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Owing to their specific photoperiodic requirements, different exotic genotypes of Populus were introduced in Terai region of Uttar Pradesh. The indigenous clones were also developed from open pollinated seeds. Their screening was conducted in nursery to select promising ones which were further studied in populetum. Afterwards they were evaluated in field. Overall performance of indigenous and American clones was found better than those obtained from other sources. Some of the outstanding clones were S7C15, S7C20, G-48, I-18/62, L-34, L-52, EL-74, S7C1, D-75, L-51/84, L-154/84, L-301/84 etc.

Poplar is a fast growing, multipurpose wood species, distributed throughout the forests of temperate and cold regions of Northern Hemisphere between 30°N and 45°N. There are exceptions found further down to equator even other side of it (Chaturvedi, 1981). Indigenous Poplars have a limited distribution (Mathur and Sharma, 1983). However, none of the Himalayan species are important for timber production (Chandra, 1986). This led to introduction of exotic Poplars in Sub-montane and Terai region of Uttar Pradesh. From initial experiments with different species of *Populus*, it was concluded that suitable clones of *Populus deltoides* (timber producing species) and its hybrid (*P. x euramaricana*) can be successfully cultivated in Terai belt of 28°-30° parallel (Seth, 1969). Since then hundreds of clones (genotypes) of *P. deltoides*, *P. x euramaricana*, *P. nigra* and *P. trichocarpa* have been introduced for nursery and field trials under Terai conditions. Simultaneously indigenous clones were also developed from introduced as well as locally collected open pollinated seeds, and evaluated. Some details of collections, maintenance, nursery and field testing of different clones of *Populus* species are discussed in this paper.

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MATERIALS AND METHODS

Exotic clones introduced from Afghanistan, Australia, Austria, Germany, Italy, Netherlands, Pakistan, Turkey, USA and locally developed ones at Lalkua in Nainital district were first tested in nursery. Nursery testing, populetum establishment and field evaluation were done at Lalkua, Gangapur Patia and Phoolbagh under Silviculture Division, Sal Region, U.P. during last decade. Check clone used was an Australian G-3 of *Populus deltoides*. Location, soil characters and meteorological data of the three experimental sites are as follows:

LOCATION DATA

Characters	Lalkua	Gangapur Patia	Phoolbagh
Latitude	29°10'N	29°7'N	29°7'N
Longitude	79°40'E	79°40'E	79°27'E
Altitude	256m	247m	248m
Soil type	Sandy loam to loam	Sandy loam to loam	Sandy loam to clayey
Soil pH	7.15	7.0	8.1
% Organic Carbon	70	79	71
Exchangable K_2O (Kg ha ⁻¹)	207	184	168
Exchangable P_2O_5 (Kg ha ⁻¹)	165	160	120
Soil depth	1-2m	2-3m	2-3m

METEOROLOGICAL DATA

Month	Temperature°C		Rainfall (mm)
	Mean Max.	Mean Min.	
January	20.7	7.0	44.7
February	22.9	9.2	36.0
March	29.7	13.9	14.9
April	35.7	19.6	28.9
May	38.5	24.2	6.3
June	37.0	26.0	126.7
July	32.5	25.2	471.1
August	31.5	24.8	398.5
September	31.9	23.4	320.2
October	31.2	17.7	15.7
November	26.7	11.1	2.5
December	21.7	7.3	14.4

The cuttings were planted vertically in well worked nursery beds of 10m x 4m size in a randomised block design (RBD) with 3 replications. 7 x 7 cuttings per replication were spaced at 80 cm x 60 cm. About 200 kg farmyard manure was applied per bed. Irrigation was done twice a week till onset of rainy season. Weeding and hoeing were done frequently as and when required. In case of two or more sprouts, singling was done. One year old plants were measured individually. Promising clones were preserved in populeturns.

Populeturns were created by planting entire transplants (ETP) in RBD. ETP pre-treated with Emison, a fungicide, and Aldrin, an insecticide, were planted in 75 cm x 30 cm x 30 cm pits. Number of plants per replication was generally low and spacing was kept at 5 m x 3 m. Irrigation was done weekly in first year and fortnightly in second year till the onset of rains. Hoeing and weeding were done as and when required. Data were recorded annually on different characters like branching habit, leaf fall, leaf sprouting, disease susceptibility etc. on individual plants.

For field evaluation, the clones performing well at nursery and in populeturn were selected and evaluated. Planting method adopted was the same as in case of populeturns. Plants per replication were high, generally 49. Measurements were recorded annually to assess the high yielding promising genotypes. Good survival per cent, height, diameter, disease resistance and straight bole upto a considerable height were the parameters chosen for selection of promising clones both in nursery and field testing.

RESULTS AND DISCUSSION

Nursery testing

Indigenous clones (126) were tested in 1982 for five consecutive years and 9 promising clones (L-12, L-13, L-29, L-30, L-34, L-49, L-52, EL-74, and EL-89) were further screened for field trials. Clones L-12 and L-13 exhibited top branching, leaf crumpling and reduction in leaf size and plant height due to incidence of *Scriptothrips dorsalis*. Same symptoms were observed on mother clone G-48 also. However, plants recovered very fast immediately after few initial showers. In another experiment in 1986, a set of 168 exotic clones introduced from U.S.A. were tested in nursery for four consecutive years. Some of the *P. deltoides* clones (3-8, 9-8 and 64-047-5) did not sprout, others showed inferior growth than control. All the *P. trichocarpa* clones were seen infected. Only 10 promising clones of *P. deltoides* (S7C1, S7C2, ST-72, 64-243-1, 110120, 110702, 113324, S7C4, 1467 and 111828) were finally selected. In third experiment, eighty nine clones (exotic and indigenous) were screened in 1986. L-29, L-30, L-34, L-49, EL-125, L-39, L-52, EL-183,

EL-83 amongst indigenous clones and A-24, ST-6, S-748/111, 4/68, 61/58, 69/55, S7C15, 63/51, 3-12(5), 73/53(7), Fereillo, 2504 amongst the exotic clones were scored as promising. Another set of indigenous clones of 1984 selection were screened in nursery for three years. More than forty clones were found promising. As indicated by initial performance, selections done during 1984 were better than the 1982 selections. In 1989, nursery testing of 610 indigenous hybrid (*P. ciliata* × *P. deltoides*) clones was started. After two screenings, 22 clones have been found promising. Among them, best ones are L-24/88, L-40/88, L-52/88 and L-66/88. The offsprings in these cases, have inherited dominant characters from female parents e.g., leaf shape and size, good growth, stem form etc.

Populeturns

About 300 clones (exotic and indigenous) were preserved in the populeturns established in different years at two sites i.e., Gangapur Patia and Phoolbagh. Some of the significant characters studied are compiled in Table 1 and 2. Leaf size is the average length and width of fifty leaves selected randomly. Whole range (leaf length) is categorized into three groups, i.e., large (13.1cm-17cm), medium (9.1cm-13cm) and small (5cm-9cm). Leaf size of control clone falls under medium category. Leaf fall and leaf sprouting period indicates completion of leaf shedding and starting of leaf sprouting. Completion of the latter was observed within 20-30 days.

Field performance

Sixty exotic clones were put under evaluation trial in 1985. After six years of growth, nine clones, i.e., D-75, S7C20, S7C8, D-66, S7C15, S7C1, 2502, 72/58 and 69/55 proved promising. In 1986, thirty four clones (both exotic and indigenous) were planted for field evaluation. Sixteen clones G-48, I-18/62, S7C15, S7C8, D-82, S7C20, D-124, L-12, L-49, EL-74, L-34, EL-71, L-30, L-29, L-52 and EL-89 were found better than check clone (Australian G-3). Indigenous clones transplanted in the field in 1986 produced some superior clones which are L-12, L-13, L-22, L-29, L-30, L-34, L-49, L-52, EL-67, EL-74, EL-89, EL-114, EL-117 and EL-125. In general, clones of local origin (L) were better than those of exotic ones (EL). Out of seventy five exotic clones tested in field in 1988, fourteen clones i.e., S7C1, S7C2, 82-33-3, 110120, 110702, 113324, S7C4, 1467, G-48, D-121, 3324, 82-40-2, S4C2 and 3565 were promising. All these selected clones except G-48 are of American origin. A set of indigenous clones of 84 selection were also put in field. They showed much better growth than any other clones. On the basis of comparative growth performance and other characters like good stem form and disease resistance, different clones were categorised into three groups viz., good, promising and poor (Table 1 and 2). The control clone G-3 is of

Table 1: Characteristics of promising genotypes of *Populus deltoides*

Clones	Source Origin.	Average leaf size	Leaf fall week	Leaf sprouting week	Sex and other characters
G-3 (Control)	Australia	medium	Jan. I	March-IV	Male, Pygaera attack
G-48	Australia	medium	Jan. I	March-IV	Female
65/27	Australia	small	-	-	Evergreen
D-121	U.S.A.	medium	Dec. III	March-IV	Female
L-12	India*	medium	Dec. IV	March-IV	-
L-29	India*	medium	Dec. IV	March-II	-
L-30	India*	small	Jan. I	March-II	-
L-34	India*	medium	Jan. I	March-III	-
L-23/84	India*	medium	Jan. I	March-II	Forking
L-24/84	India*	medium	Dec. III	March-III	-
L-39/84	India*	medium	Dec. IV	March-III	-
L-51/84	India*	small	Dec. IV	March-II	-
L-55/84	India*	medium	Jan. I	March-III	-
L-71/84	India*	small	Dec. III	March-II	-
L-72/84	India*	medium	Dec. III	March-II	-
L-133/84	India*	medium	Dec. II	March-II	-
L-142/84	India*	medium	Dec. III	March-III	-
L-153/84	India*	medium	Jan. I	March-II	-
L-154/84	India*	medium	Dec. III	March-II	-
L-162/84	India*	medium	Jan. I	March-III	-
L-169/84	India*	small	Dec. IV	March-II	-
L-215/84	India*	medium	Dec. II	March-III	-
L-247/84	India*	small	Dec. IV	March-II	-
L-301/84	India*	medium	Dec. III	March-II	-
L-303/84	India*	small	Dec. IV	March-III	Pygaera attack

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TABLE 2: Promising genotypes of *Populus deltoides*

Sl. No.	Clones	Source/ Origin	Sl. No.	Clones	Source/ Origin
1.	74/24	Australia	46.	69/55	Italy
2.	S-748/111	Australia	47.	Eco-28	Italy
3.	28/13	Australia	48.	Spido	Italy
4.	69/58	Australia	49.	2502	Netherland
5.	P.'IC'	U.S.A.	50.	2503	Netherland
6.	D-61	U.S.A.	51.	2653	Netherland
7.	D-66	U.S.A.	52.	2656	Netherland
8.	D-67	U.S.A.	53.	2673	Netherland
9.	D-75	U.S.A.	54.	3650	Netherland
10.	D-82	U.S.A.	55.	3686	Netherland
11.	D-124	U.S.A.	56.	L-13	India*
12.	D-171	U.S.A.			India*
13.	S7C1	U.S.A.	57.	L-49	India*
14.	S7C4	U.S.A.	58.	L-52	India*
15.	S7C8	U.S.A.	59.	EL-74	India*
16.	S7C15	U.S.A.	60.	EL-117	India*
17.	S7C20	U.S.A.	61.	EL-125	India*
18.	S4C2	U.S.A.	62.	L-57/84	India*
19.	ST-66	U.S.A.	63.	L-58/84	India*
20.	ST-67	U.S.A.	64.	L-62/84	India*
21.	ST-92	U.S.A.	65.	L-68/84	India*
22.	ST-109	U.S.A.	66.	L-49/84	India*
23.	118	U.S.A.	67.	L-75/84	India*
24.	3167	U.S.A.	68.	L-129/84	India*
25.	3263	U.S.A.	69.	L-130/84	India*
26.	3324	U.S.A.	70.	L-152/84	India*
27.	3567	U.S.A.	71.	L-158/84	India*
28.	721502	U.S.A.	72.	L-165/84	India*
29.	82-33-3	U.S.A.	73.	L-168/84	India*
30.	82-42-5	U.S.A.	74.	L-176/84	India*
31.	82-40-2	U.S.A.	75.	L-179/84	India*
32.	63/51	U.S.A.	76.	L-181/84	India*
33.	I-18/62*	Pakistan	77.	L-182/84	India*
34.	A-13	West Germany	78.	L-188/84	India*
35.	A-26	West Germany	79.	L-198/84	India*
36.	A-37	West Germany	80.	L-200/84	India*
37.	A-194	West Germany	81.	L-224/84	India*
38.	1/56	West Germany	82.	L-229/84	India*
39.	2/56	West Germany	83.	L-290/84	India*
40.	TRIPLO*	Italy	84.	L-291/84	India*
41.	Luisa-Avanzo*	Italy	85.	L-293/84	India*
42.	CIMA*	Italy	86.	L-296/84	India*
43.	GUARDI*	Italy	87.	L-297/84	India*
44.	Lux	Italy	88.	L-299/84	India*
45.	ONDA	Italy	89.	L304/84	India*

* clones of *P. euramaricana*

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Australian origin which was an American selection and an established commercial clone of *Terai* region. Out of 291 clones evaluated, 24 were good, 89 promising and 178 poor. Among 24 good clones, 2 were of Australian, 1 of United States and remaining indigenous origin. Majority of the promising clones were either indigenous (57%) or American (31%). German, Dutch and Italian clones showed poor adaptability to *Terai* conditions. This may be due to latitudinal correlation of the place (Tiwari 1988).

The observation revealed that planting height and diameter of ETP do not affect overall growth of the tree significantly. This supports earlier reports of Chaturvedi (1981) and Singh (1989). However, growth of few promising clones, i.e., S7C1, S7C4, S7C15, G-3, L-12, L-13, L-34, G-48 were found enhanced when grown in combination with medicinal plants and agricultural crops as intercropping practice. Earlier findings of Mathur and Sharma (1983), Anonymous (1987), Singh *et al.* (1988) and Jha and Gupta (1991) were also in agreement with this.

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