

INTRODUCTION OF POPLAR SPECIES IN MAHARASHTRA STATE - AN ASSESSMENT

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Introduction

Poplars are amongst the world's fastest growing industrial soft-wood which can be harvested within a reasonably short period of even 8-10 years depending on the end-use. Poplars can be grown as pure or mixed plantations as well as combining with agriculture crops under Agro-forestry practices. Poplar wood is excellent for manufacture of matches, veneers, fibreboards, paper-pulp, light packaging etc. and consequently enjoys perpetual large-scale demand. Poplars naturally occur interspersed throughout the forests of temperate and cold regions of Northern Hemisphere, between 30° to 45° N latitude. Our indigenous poplars come up well in areas having temperature variation from 6°C to 18°C.

Poplars (Genus *Populus*) belong to family Salicaceae which also includes Willows. In fact, poplars were first tried in the Western Ghats plateau of Maharashtra during 1979-80 and met with very limited success, may be due to incorrect method of planting. It was the general belief that poplars would not come up at all in the

areas outside its natural habitat, especially South of 28°N latitude but its promising growth in the initial trials and the occurrence of another species i.e. Willow plants belongs to the same family planted by the then Maharaja of erstwhile Kolhapur State along the river-banks in Kolhapur and Satara Districts, prompted Mr. M.G. Gogate, the then Conservator of Forests (Research), Pune to re-examine the potential of Poplar for its introduction around Nashik during 1985 to 1987 and subsequently to other parts of District Pune and Satara in the 1990s. Poplars being a fast growing species and most suitable softwood species for packing cases industry was another deciding factor for its introduction and cultivation in Western Maharashtra, as this would prove to be complementary to the flourishing grape and other horticultural crops in this part of the State.

Objectives

In 1985 and in 1992, various clones of Poplar brought from different origins have been taken up for trials with the following objectives :

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- (1) To reintroduce the different cultivars of poplars in different regions like Nashik, Pune and Sangli Districts of Western Ghats areas and test its growth potentials and adaptability; and

- (2) To introduce it as a suitable substitute for ever demanding packing case industry which requires a lot of raw material for the flourishing grape and other horticultural crops of this region.

Altitude, Temperature, Rainfall and Locations

The altitude of these trial locations varies from 500 m to 600 m above msl as given in Table 1.

The exact locations where the Poplar

Table 1

Climate and altitude data of trial sites

Place	Temp. (°C)		Rainfall (mm)	Altitude (m msl)
	Min.	Max		
Nashik	10	38-40	750 -1000	596
Pune	10	38-40	500 -750	569
Sangli (Kasegaon)	10	38-40	500 - 650	565

trials have been undertaken are given in Table 2.

Poplar cultivars (clones) in the trial

Various cultivars of various species of *Populus* were tried in different localities of Nashik, Pune and Sangli Districts which are as follows :

Table 2

Locational data of trial sites

Place	Govt./Semi Govt./ Private	District
Gangapur Nuresry	Forest Department	Nashik
Agriculture College	Government land	Pune
Hadapsar	Research Centre, Hadapsar	"
Alandi Chakan Road	Private	"
Theur	Forest Department Nursery	"
Manjari	Agriculture Farm	"
Daund	Forest Department	"
Purandar (Hivare)	Private	"
"	Stud Farm (Private)	"
Chandoli Bk.	Through Vanrai Private Farm	"
Bhaje, Vadgaon Maval taluka	Private Farm	"
Urulikanchan	Private Farm	"
Kasegaon	Private Farm	Sangli

Fig. 1

Departmental trial plantation of *Populus deltoides* (1985) G, D and S series at Gangapur Nursery, Nasik

1. *Populus deltoides* : Clone no.:
(Australian and American Source)
G3, G48, D61, D121, D181, S7C1, S7C4,
S7C8, S7C15, S7C20
2. *P. x euramericana* : Clone no. :
(American) : IC-69/55,55, IC-72/56
3. *Populus deltoides* : Clone no. :
(Netherlands) : 32/87, 32/98, 36/78, 36/86
4. *Populus nigra* : Clone no.: Tr-56/52
5. *Populus deltoides* : Clone no. :
(Australian selection) : 23/8, 28/13, 61/58,
74/24

Nursery and Planting Technique at Gangapur Nursery at Nashik : Plants can be raised from seeds and also from branch cuttings. Best cuttings are obtained from main stem of one year old healthy and vigorous plants. The dimension of cuttings should be 1 to 3 cm diameter, 18 to 25 cm in length and should contain three to five live buds. In this trial cuttings supplied from Silviculturist, Western Region, Kanpur and Silviculturist, F.R.I., Dehra Dun were used directly for planting in beds. Cuttings of 12 cultivars of *Populus deltoides* and *P. x euramericana* supplied by the Silviculturist, Southern Region, Kanpur, U.P., cuttings of 4 cultivars each of *Populus deltoides* of USA origin, unknown origin Australian source, and one cultivar of *Populus nigra* of Ankara origin, Turkey source supplied by the Director, Silviculture Research, F.R.I., Dehra Dun, were planted in the beds of two nurseries of Forest Department and Social Forestry Department as well as in plots of the private farms around Nashik during February/March 1985 as per the stipulations laid out in Nursery and plantation techniques of poplars (Anon., 1987). The performance of these trials have been assessed already by taking measurement in August 1985 and in October 1999 vide Table 3. The cultivars were planted at Gangapur Nursery in a randomized block with six plants in a row.

Introduced trials of Populus species at Agriculture College, Pune : Subsequently, encouraged by the success of the previous effort, limited material which was available out of initial screening and multiplication was used and the field trials were taken in few agricultural lands at Nashik and Pune Districts in 1986. The performance of these field trials also has found to be quite promising.

Table 3

Trial of Poplar species at Nashik (Gangapur Nursery) 1985-86

Species	Supplied by	Clone No.	Source	Origin	Assessment done in Aug. 1985			Assessment done in Oct. 1999			Remarks
					Sur.%	Av. Girth (cm)	Av. Ht. (m)	Sur.%	Av. Girth (cm)	Av. Ht. (m)	
1	2	3	4	5	6	7	8	9	10	11	12
<i>Populus deltoides</i>	Silviculturist (U.P.) Kanpur	G3	Australia	Texas (U.S.A.)	77.8	3.5	2.3	1.7	60	17	15 trees recently died and still standing <i>in-situ</i> have girth varies from 55cm to 65 cm
"	"	G48	Australia	"	68.4	3.5	2.05		All dead		
"	"	D61	America	"	89.0	5.0	2.7		All dead		
"	"	D121	"	"	76.4	4.5	2.75	8.9	44.5	14	
"	"	D181	"	"	94.4	6.5	3.75	6	47.10	14	
"	"	S7C1	"	Stoneville (U.S.A.)	96.9	5.0	2.6		All dead		
"	"	S7C4	"	"	98.9	5.5	2.4	7.5	31.7	11.5	Date of measurement
"	Silviculturist (U.P.)	S7C8	"	"	79.9	5.5	3.5	13.4	40.8	12.0	22-10-1999
"	"	S7C15	"	"	73.4	2.0	1.0	—	—	—	
"	"	S7C20	"	"	91.1	5.0	3.25	2.2	47.5	13.0	
<i>P. x euramer-icana</i>	"	IC-69/55	"	"	80.6	5.0	2.5	—	—	—	All dead
"	"	IC-72/56	"	"	75.9	2.0	0.65	—	—	—	—do—
<i>Populus deltoides</i>	Director Res., F.R.I., Dehra Dun	32/87	Netherlands	Nebraska (U.S.A.)	79.0	1.5	0.65	—	—	—	—do—
<i>Populus deltoides</i>	"	32/98	Netherlands	Nebraska (U.S.A.)	73.4	1.5	1.0	—	—	—	—do—

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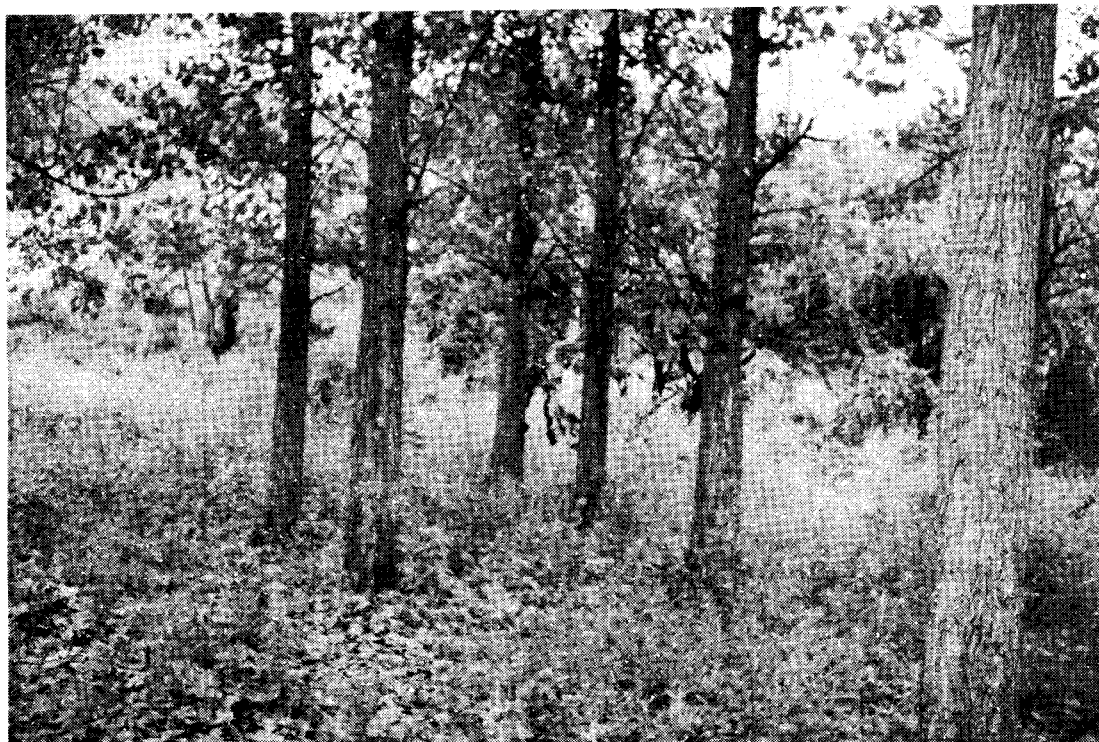
1	2	3	4	5	6	7	8	9	10	11	12
<i>Populus</i>	"	36/78	Netherlands	Illinois	63.2	1.5	0.6	—	—	—	—do—
<i>deltoides</i>				(U.S.A.)							
"	"	36/86	"	Kansas	73.7	1.5	0.7	—	—	—	All dead
				(U.S.A.)							
<i>Populus</i>	"	Tr-56/52	Turkey	Ankara	86.5	1.5	0.5	—	—	—	—do—
<i>nigra</i>											
<i>Populus</i>	"	28/8	Australia	Unknown	70.7	2.5	0.7	—	—	—	—do—
<i>deltoides</i>											
"	"	28/13	"	"	73.9	1.5	1.2	—	—	—	—do—
"	"	61/58	"	"	56.0	2.0	0.6	—	—	—	—do—
"	"	74/24	"	"	61.8	1.5	1.1	—	—	—	—do—

Table 4

Trial of Poplar species at Agriculture College, Pune-1992 (Winter)

Species	Clone	Number planted	No. Sur.	Survival (%)	Girth (cm)			Height (m)			Remarks
					Av.	Max.	Min.	Av.	Max.	Min.	
<i>Populus</i>	L12	48	27	56.25	78.33	110	17	12.31	14.90	6.50	(1) Date of Planting 8-2-92 to 12-2-92
<i>deltoides</i>											
"	L13	48	27	56.25	55.00	82	28	11.80	13.70	7.50	(2) Assessment year Oct. 1999
"	L29	48	19	49.58	54.89	76	20	14.46	12.70	9.50	
"	S7C1	52	33	63.46	58.27	95	9	12.66	14.90	2.70	(3) Cultivar supplied by Silviculturist, Haldwani, U.P.
"	S7C8	48	21	43.75	52.23	76	26	11.50	13.50	1.75	
"	N-control	52	12	23.07	26.14	38	9	4.85	8.50	2.50	and Tata Energy Research Institute, Delhi.

Fig. 2



Trials of *Populus deltoides* (Clone L & S Series) at Agriculture College, Pune in 1992

Considering the performance and relative success of these trials of poplars, an introduction trial had been taken up in the agriculture field of College of Agriculture, Pune in Feb. 1992 on a better footing. Here, 5 cultivars of *Populus* of L & S series supplied by the Silviculturist, Haldwani, Uttaranchal and Tata Energy Research Institute, Delhi, were tried out by using Entire Trans-Plants (ETPs) method in a properly laid out statistical design involving 2 replicates of 6 blocks, each containing 24 ETPs with control Poplar plants brought from Nashik. Pits of 3 m x 3 m filled with fertile soil, cowdung in 2:1 ratio and BHC powder were used for planting. The assessment done in

September 1992 showed poor result of survival due to some unavoidable delay in outplanting the ETPs. Later, in March 1993 the ETPs apparently thought to be dead, were cut-back immediately and it was noticed later that the cut-back ETPs responded very well and sprouted and flourished nicely. As per the assessment in September 1993 the position of survival improved considerably. Another assessment was taken in October 1999 by taking actual measurement of surviving plants which shows very good results (Table 4).

Trial of Poplar cultivars at Hadapsar, Pune:
The cuttings of 12 cultivars of poplars of L

Table 5

Trial of *Populus* species at Hadapsar Research Station, Pune

Species	Clone	Number Surviving	Average Girth (cm)	Average Height (m)	Remarks
<i>Populus deltoides</i>	L27, L30, L36, L39, L47, L51, L52, L62, L165, L181, L29, S7C8	—	—	—	(1) All plants died due to White Ant attack (2) Year of Planting- February 1992 (3) Year of assessment -Nov. 1999
—	L29/82, L32/82	1	Below 7 cm	5.50	The growth is not much because the cuttings were removed every year for supplying to the private people.
—	L13	15	—	5.06	
—	L12/82	5	—	4.80	
—	G3	15	—	4.74	
—	S7C1	2	—	4.00	

Table 6

Trial plantations of *Populus* species at different places in Pune District

Assessment year - November 1999

Location	Species	No. of cuttings planted	No. survived	Survival (%)	Girth (cm)			Height (m)			Remarks
					Av.	Max.	Min.	Av.	Max.	Min.	
1	2	3	4	5	6	7	8	9	10	11	12
*Private farm at Chandoli Bk, Tal. Ambegaon. (6 Farmers)	* <i>Populus deltoides</i>	Not known	22	Can not be assessed	56.95	92	6	11	14	2.5	(1) All plants are planted the bunds of the fields which are irrigated. (2) Date of planting: Feb March 1994

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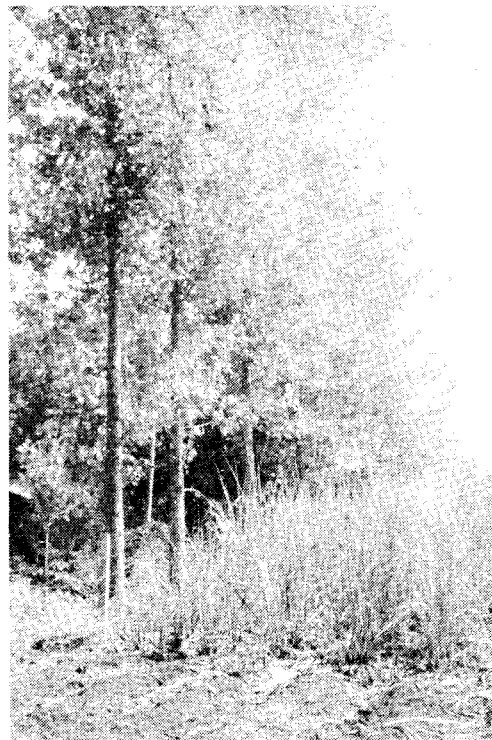
1	2	3	4	5	6	7	8	9	10	11	12
*Manjari farm Manjari (Govt. land)	"	Not Known	4	—"	39	46	31	7.5	9.5	5	(1) Date of planting: Feb- March 1994 (2) Irrigation not done.
Prayag Dham (Naigaon, near Urulikanchan)	"	160	155	96.90	66.40	101	44	13.78	19.25	9.5	(1) Cutting procured from Kashmir. (2) Planted along roadside as avenue. (3) Distance between 2 trees 2m (4) Plantation fully irrigated. (5) Date of planting: Feb- March 1990.
Mayur Dhaba, Alandi-Chakan Road	"	30	30	100	36.5	61	24	12	14.50	10	(1) Date of planting: Feb- March 1992 (2) Planting Distance - 1.5 x 1.5 m (3) Plantation fully irrigated. (4) Cutting obtained from private Nursery.

*Names of the Clones are not known

Fig. 3



Fig. 4



Trials of *Populus deltoides* in bund planting at Kasegaon, Sangli Distt. (Year 1992)

& S series supplied by the Silviculturist, Haldwani, Uttanchal, and Tata Energy Research Institute, Delhi were also planted in the Nursery beds at Hadapsar in February 1992 and their performance initially noted in September 1992 and taken again in 1996 was noticed to be encouraging. However as per the measurement in October 1999 all cultivars were found to have died due to white ant attack. Few cultivars, which are surviving, do not show sufficient growth in girth and height (Table 5).

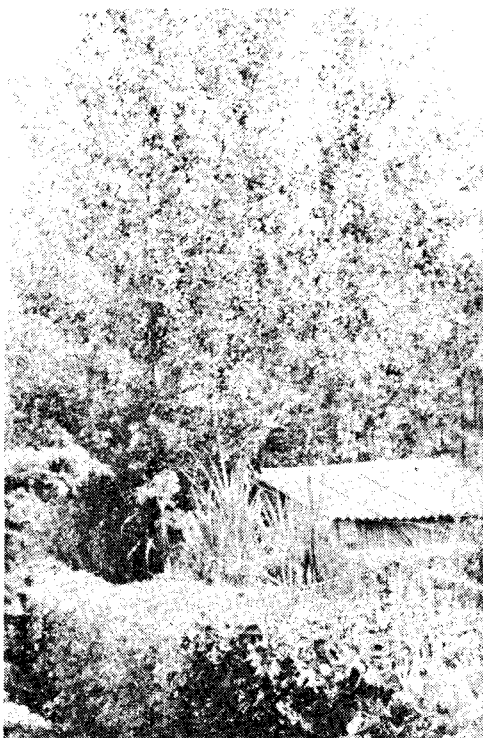
Private Trial plantation of Poplar species at different places in Pune District : As an extension service, in the year 1992-93 and

1993-94 the Silviculturist (M.S.) Pune had supplied cuttings of *Populus deltoides* to various private farmers for planting in their agricultural fields. The details have been shown in Table 6. The cuttings were supplied to private farmer at Chandoli Block through Vanrai in 1993-94. They were planted on the bunds. Though the records were not maintained properly by the farmers, measurements taken in October 1999 show that these plants are doing very well.

Likewise, at Manjari Farm, the existing four plants are show moderate success.

Table 7
Trial plantation of Poplar at Kasegaon, at Sangli

Location	:	Private Sr. No. 1164 at Kasegaon, Tal. Walva, Distt. Sangli										
Name of the owner	:	Shri Kulkarni of Mahak Plantations										
Cutting supplied by	:	Silviculturist, M.S., Pune from Hadapsar Research Station, Pune										
Year	:	1992-1000 cutting, Year 1998-2000 cuttings.										
Year of assessment	:	Nov. 1999 Date of measurement - 28-10-99 to 30-10-99										
(Recorded by Research Staff, Koyana)												
Year of planting	Species	Clone	Number planted	Number Surviving	Sur. %	Girth (cm)			Height (m)			Remarks
						Av.	Max.	Min.	Av.	Max.	Min.	
1992	<i>Populus deltoides</i>	L29, L12/82, G3, L13, L29/82	1000	86	8.6	30.13	103	10	8	20	5	Espacement 1.25 m x 2 m cuttings planted by ploughing land with tractor. Intercrop soybean was taken.
1998	"	"	2000	1093	54.65	Below 7	22	Below 7	1.78	8.00	0.15	Watering for Feb.98 to May 98 four times only. Different clones were not separately planted.

Fig. 5

Private plantation of *Populus deltoides*
(1992) at Alandi-Chakan Road,
District Pune

The private people and institutions like Mayur Hotel at Alandi and the Prayag Dham near BAIF, Urulikanchan respectively procured Poplar cuttings from various sources. Prayag Dham obtained the clones from Kashmir and planted these as avenue trees on the roadside. The Mayur Hotel planted the cuttings at the Hotel site under their close supervision. In both these places, the plants are performing very well (Table 6).

Private Trial plantations of Poplar in Sangli District : Two plantations of Poplar have been undertaken by Shri Kulkarni, a private

entrepreneur during 1992 and 1998 for obtaining some revenue in his waste-land at Sangli (Kasegaon). Cuttings of *Populus deltoides* were supplied by Silviculturist (M.S.) Pune. Espacement applied was 1.25 m x 2 m after properly ploughing the land by tractor. Inter crop of Soybean was also taken. Watering was done 4 times/year. The measurements taken in October 1999 are shown in Table 7.

Results and Discussion

Initially, when the assessment was done in September 1992, the cultivars from Australia, Netherlands and Turkey supplied by F.R.I., Dehra Dun did not show much promise in girth and height growth even though survival was very good at Gangapur Nursery. As expected, during this 14 years period, these cultivars were completely eliminated from the field by natural selection and no traces of the same were found. But, the cultivars of G, D and S series supplied by Silviculturist, Kanpur, U.P. have proved to be more promising in the initial stage as well as in the present stage. As per the current measurement, the cultivars of G3, D121, D181, S7C4, S7C8 and S7C20 are still better surviving and putting on better height and girth as seen in Table 3. However, it is seen that G48 cultivar was initially as well as in October 1996 assessment surviving very well but completely eliminated from the field in the last 3 years. In the order of merit by their performance, clones are graded as S7C8 < D121 < S7C4 < D181 < S7C20 < G3.

In the introduction trials at the campus of College of Agriculture of Pune, entirely new type of 5 cultivars of *Populus deltoides* viz., L12, L13, L29, S7C1 and S7C8 and

cuttings from probably Gangapur nursery in Nashik District were planted using statistical design. Clay Soil was replaced with fertile loamy soil and cowdung mixture in the pits. It is observed that right from the beginning, all the 5 cultivars are showing very good response. However, the control plants brought from Nashik show poor survival and poor growth. The reason for best results of other cultivars can be attributed to the good climate, better planting technique and cultural operations adopted and proper watering with good drainage. The performance of cultivars can be graded based on their performance as S7C1 < L12 < L13 < L29 < S7C8.

At Hadapsar Research Center, Pune, about 12 cultivars of L & S series planted in Feb. 1992 brought from Silviculturist, Haldwani and Tata Energy Research Institute, Delhi. Initially the survival was 70 to 90%, but subsequently all died due to white ant attack.

As seen in the Table 6, the clones of *Populus deltoides* supplied by Silviculturist (M.S.) Pune and the clones received from Kashmir source which were planted in their respective fields by private people show very good result in respect of survival, height and girth. It is also observed that most of them planted the clones on the bunds along the pathways and agricultural fields. The average height varies from 11-13 m and average girth varies from 56-66 cm.

Another Poplar trial taken up at Sangli Distt. by private entrepreneur shows a moderate growth of Poplar in the new environment with alkaline soil and poor drainage. The trial in the place is not encouraging.

Conclusions

Perusal of the Tables 3-7 shows that :

- (i) Three Poplars species viz., *Populus deltoides*, *P. x euramericana* and *Populus nigra* of different origin and source were tried. Out of this *P. x euramericana* and *Populus nigra* species were completely eliminated in the field by natural selection. Only few clones of *Populus deltoides* of Texas origin, source from Australia and America are surviving very well.
- (ii) The better performing clones of *Populus deltoides* at Nashik are shown in the ascending order as S7C8 < D121 < S7C4 < D181 < S7C20 < G3, depending upon their performance.
- (iii) Almost all the clones from Haldwani, Uttaranchal and Delhi introduced at Agricultural College, Pune are showing good results in survival, girth and height and it appears more adaptable to this area. The descending order of clones based on the performance are S7C1 > L12 > L13 > L29 > S7C8. These clones can definitely be introduced for large-scale plantations elsewhere by using the similar planting techniques adopted in the trial.
- (iv) Poplar plants are better surviving and put on better girth and height on raised bunds rather than in the plain fields as noticed in the private farm trials at Chandoli Block, Manjari, Prayag Dham and Alandi in Pune District and also in Sangli District.
- (v) Performance of *Populus deltoides* in the plain area in Sangli District was not encouraging probably because the

area was a sugarcane field earlier and was holding more water.

(vi) After assessing wood demand, the

successful clones of *Populus deltoides* can be taken up as a plantation in districts like Pune, Nashik and Sangli since the climate is suitable.

SUMMARY

Poplars were first introduced in Maharashtra in the year 1979-1980 in Western Ghat Plateau zone. However, this maiden effort met with very limited success due to the incorrect methods of planting. Renewed efforts were made to reintroduce poplars in the sub-mountain zone i.e., Eastern aspect of Western Ghats (rain-shadow zone) during 1985-1986 with the objective to compensate and ease the load on packing-case wood problem. Poplar being a soft wood species will be complementary to the packing case industry which supplies cases to grape and other horticultural crops cultivations in Western Maharashtra. Cuttings of 12 cultivars (clones) of *Populus deltoides*, 2 cultivars (clones) of *P. x euramericana* supplied by the Silviculturist, Southern region, Kanpur, U.P. 4 cultivars each of *Populus deltoides* of U.S.A. origin, Australian source and 1 cultivar of *Populus nigra* of Ankara origin, Turkey source supplied by Silviculture Division, F.R.I., Dehra Dun were tried in two nurseries of Forest Department and Directorate of Social Forestry, as well as in private people's plots and farms around Nashik and Pune Districts during February/March 1985. Impressed by the relative success of these trials of poplars carried out earlier, introduction trials were taken up in College of Agriculture, Pune during Feb. 1992 by using Entire Transplants (ETPs) of 5 cultivars of L & S series from Haldwani and Tata Energy Research Institute, Delhi. These are discussed here since the success is impressive. The performance of the above mentioned cultivars are assessed in light of measurements taken in October, 1999.

महाराष्ट्र राज्य में पोपलर आनयन के परीक्षण—एक समाकलन
ए०एन० बल्लाल, एम०जी० गोगटे, एस०डी० दक्षिन्दास व एम० करूणाकरन
सारांश

महाराष्ट्र में पोपलर सर्वप्रथम 1979-80 में पश्चिमी घाट के पठारी क्षेत्र में लाकर लगाए जाने पर आरम्भ हुआ। रोपने की गलत विधि अपनाई जाने के कारण इस नवप्रयास में बहुत कम सफलता मिल पाई। उप-पर्वतीय क्षेत्रों अर्थात् पश्चिमी घाट के पूर्वी ऋखों (वर्षा की छाया वाले क्षेत्र) में पुनरपि पोपलर लगाने के नये प्रयत्न 1985-86 में इस उद्देश्य से आरम्भ किए गए कि पेटियां बनाने की उपयुक्त लकड़ी मिलने की भरपाई करने की समस्या हल की जा सके तथा उसका दबाव कम किया जा सके। पोपलर की लकड़ी मृदुकाष्ठ जाति की होती है और इसीलिए पेटियां तैयार करने के उद्योग में वह संपूरक रहेंगी जो ऐसा उद्योग है जो अंगूरों और अन्य बागवानी उपजों की खेती करने वालों को अपेक्षित मालबन्धाई पेटियां उपलब्ध कराता है। पोपुलस डेल्टायडिस के 12 कृषिकृत-विभेदों (कुन्तकों) की कलमें, पो० x यूरामेरिकाना के 2 कृषिकृत विभेद जो वन-संवर्धनिक, दक्षिणी क्षेत्र, कानपुर, उ०प्र० ने उपलब्ध कराए, तथा वन संवर्धन प्रभाग, वन अनुसंधान संस्थान, देहरादून द्वारा उपलब्ध कराए गए सं० रा० अमेरिकी उद्गम, आस्ट्रेलियाई स्रोत के पोपुलस डेल्टायडिस के प्रत्येक के 4 कृषिकृत विभेद तथा अंकारा, तुर्की उद्गम के पोपुलस नाइग्रा का / कृषिकृत विभेद वन विभाग तथा सामाजिक वानिकी निदेशालय की दो रोपणियों में, तथा उसके साथ-साथ नासिक और पुणे जिलों के आसपास लगते किसानों के निजी खेतों और फार्मों (प्रक्षेत्रों) फरवरी/मार्च 1985 में परीक्षणार्थ लगाए गए। पोपलरों पर पूर्वतर कराए गए परीक्षणों तथा कृषि महाविद्यालय, पुणे द्वारा फरवरी 1992 में कराए इन आनयन परीक्षणों की सफलता से सापेक्ष प्रभावित होकर, जिनमें पूरे पौधों का प्रतिरोपण विधि हल्द्वानी और टाटा ऊर्जा अनुसन्धान संस्थान, दिल्ली से मिले एल व एस श्रृंखला के 5 कृषिकृत

विभेदों के लिए उपयोग में लाई गई थी, इन्हें यहां विवेचित किया जा रहा है, क्योंकि इनकी सफलता वस्तुतः प्रभावकारी रही है। ऊपर बताए कृषिकृत विभेदों की क्रियाशीलता का समाकलन अक्टूबर 1999 में लिए गए इनके वर्तमान मापों के आधार पर किया गया है।

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