

Future of Poplar in India

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Poplar is a very prominent taxonomical group of tree species in plantation forestry in India. It occurs in natural forests also. However, its population in natural stands is small and is gradually declining. Bulk of the plantations are composed of *Populus deltoides*, an exotic species. The area coverage and productivity of this species is bound to increase further, due to concerted research and development efforts aiming at its genetic improvement. Indigenous poplars occur only in the mountains and are still to acquire greater role and share in afforestation/reforestation programmes and conservation.

Species

a) Indigenous species:

Indigenous species of poplar occur in the Himalayan region in northern part of India.

P. ciliata: The species is distributed from Kashmir to Arunachal Pradesh at 1300 to 3000 m altitude. This is the most widespread species of native poplars. Trees usually occur on the banks of water courses.

P. gamblei: This is the southernmost species of poplar in India and occurs at 600 to 1100 m altitude in Arunachal Pradesh.

P. jacquemontii var *glauc*: It is distributed in Tonglo in Sikkim and Eastern Nepal at an altitude of 2500 to 2900 m. It has bisexual flowers.

P. rotundifolia: It is distributed in Bhutan Himalayas close to Indian border at 2300 to 3050 m altitude.

P. euphratica: It occurs in Ladakh region of Jammu and Kashmir and extends to the Punjab and Sindh (Pakistan), Tibet, Afghanistan, Iran, Iraq and Turkey.

P. alba: It occurs in Pooh division in Kannaur, Himachal Pradesh and parts of Kashmir and Laddakh.

b) Exotic species:

P. deltoides: This is the most widely planted species of poplar in India. It was introduced in India in the late 1950s. It is planted in plains of North- West India, i.e., Western Uttar Pradesh, Punjab and Haryana and to some extent in the outer plains/ valleys of Uttaranchal and Himachal Pradesh.

P. nigra: This occurs in avenue plantations in Kashmir valley.

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Other species/hybrids:

P. x euramericana and *P. x berolinensis* were introduced in India in 1950. Clones of *P. canescens*, *P. maximowiczii*, *P. trichocarpa*, *P. simonii*, *P. szechuanica*, *P. yunnanensis*, etc. were introduced in the subsequent years. *P. deltoides* performed better than all other exotic poplars in the plains of North India, and relegated most other exotic poplars to the status of anonymity in India. In the hills, *P. yunnanensis* and *P. x euramericana* 'Robusta' proved better than other species (Seth, 1969).

a) Indigenous poplars

Cultivation:

Among indigenous species, only *P. ciliata* is grown to a noticeable extent in plantation programmes in the Himalayan region of North India. It is planted by State Forest Departments near villages in mixture with other hardwood species. It has also been recommended for agroforestry plantation around orchards. Due to fast growth rate, it has the potential and scope of being included more in the plantation programmes in its natural zone of occurrence. Presently, the species constitutes a small proportion of trees in the conifer-dominated Himalayan region.

P. euphratica and *P. alba* are neither planted nor do they regenerate readily due to the absence of seeds caused by lopping. There is strong need for conservation and afforestation of these species.

While *P. euphratica* is not being planted in its natural range, plantation trials of the species have been conducted in hot and dry areas of Haryana (Sharma *et al*, 1999). More trials are, however, needed before drawing any conclusion about its suitability in the plains of Haryana.

Other indigenous species are not favourite in plantation programmes, but they regenerate naturally.

Utilisation:

P. ciliata and *P. gamblei* grow fast and have the potential to enhance wood supplies for packing cases and raw material for industries. Wood of *P. ciliata* is in great demand for match industry. In Kashmir, it is used for construction purposes and as fuel. Its leaves serve as fodder for goats. Its wood has been found to be suitable for making plywood and hard boards. The wood of *P. gamblei* is suitable for plywood, match and packing case industries. *P. euphratica* and *P. alba* are used as fodder. The former grows in cold desert region and is heavily lopped. Heavy lopping prevents seed setting and natural regeneration.

Genetic improvement:

Research on genetic improvement of *P. ciliata* is underway in research institutions in the hill States of Himachal Pradesh and Uttarakhand. Provenance and clonal trials of the species are in progress. *P. ciliata* has been hybridised with *P. deltoides*, *P. yunnanensis*, *P. maximowiczii*, etc. (Handa, 2001, Jha and Kumar, 2000, Land, 1996). Himalayan Forest Research Institute, Shimla and Forest Research Institute (FRI) Dehradun have selected candidate plus trees of *P. ciliata*, *P. euphratica* and *P. alba* in North- Western India. The trees are required to be cloned and tested in field trials.

Plant Protection:

P. ciliata is severely affected by rust disease towards autumn. Most significant damage to indigenous poplars is done by human beings who top the trees for fodder. Regeneration of *P. euphratica* and *P. alba* is almost absent on account of these factors.

b) Exotic poplars:

(i) Species other than *P. deltoides*

P. nigra is planted only as avenue plantation in Kashmir valley and it does not contribute significantly to wood supply. Other exotic species of poplar have not gone beyond research stage. Only *P. deltoides* is the exotic species planted in India.

(ii) *P. deltoides*

Cultivation:

P. deltoides is the only species of poplar that is planted on a significant scale in India. *P. deltoides*, hereafter called poplar, constitutes the backbone of agroforestry in irrigated plains of Northern India. It has been estimated that 60,000 hectares equivalent plantations of poplar exists in India. Some important statistics about poplar in India are:

States where planted	Punjab, Haryana, Western Uttar Pradesh, outer plains/valleys in Uttaranchal and Himachal Pradesh
Planting sites	Irrigated agricultural lands (i.e. as agroforestry plantations)
Area under poplar	60,000 ha equivalent
Standing trees	30 million
Rotation age	6-8 years
MAI in farmers field	20-25 m ³ /ha/yr in block plantations, 2-3 m ³ /ha/yr in boundary plantations
Out turn	1.125 million m ³ /yr
Present planting/replanting rate	23,000 ha equivalent
Requirement of nursery stock	10 million entire transplant (Chandra, 2000)
Spacing	5m x 4m or 4m x 4m spacing as block plantations; or at 3m – 4m spacing in linear rows along field boundaries
Combination crops	Sugarcane, wheat, potato, mustard, maize, pulses, vegetables, fodder crops, medicinal plants etc (but not rice)
Size at harvest	At least 30" gbh

When poplar is planted on the field boundaries, kharif as well as rabi crops can be grown in field throughout the rotation of poplar. In block plantation of poplar, the usual kharif crops can be grown for two years only; thereafter shade-bearing crops like ginger, turmeric, etc. are planted. However, rabi crops can be grown as usual. Poplars also serve as a windbreak. The earliest contribution of poplar trees to the farmers is fuelwood from pruning.

Intercropping is almost always preferred as it provides agricultural returns on the one hand and results in increased growth rate of poplar on the other due to frequent irrigation and hoeing operations of agricultural crops.

Pure poplar is seldom raised. If raised pure, the spacing is kept about 3m x 3m and the stems remain thin which fetch low price in the market.

The rotation suggested for poplar cultivation in India is 10 to 12 years but farmers prefer to cut it at 6 to 8 years rotation. Unlike developed countries coppicing of poplar at cutting cycles of 3 to 4 years is not practised in India. The felled areas are replanted with fresh nursery stock.

To increase the extent of poplar plantations, FRI Dehradun has laid out introduction trials of poplar at about 20 sites in irrigated areas of Eastern Uttar Pradesh, West Bengal, Chhattisgarh, Maharashtra, Gujarat, Orissa and Bihar. The trials, likely to be concluded in 2006, will provide answer to the feasibility of extending poplar cultivation in areas outside the traditional poplar cultivation zone. (The traditional zone is confined to the plains of North- West India above 28°N latitude). The trials at the age of 2 1/2 years have given very encouraging results.

In view of (i) suitability of huge areas of irrigated agricultural lands for poplar-based agroforestry, (ii) introduction and clonal trials launched by FRI Dehradun in all potential regions, and (iii) development of approach for simultaneous testing and multiplication of promising clones, and (iv) good response of researchers and farmers of different areas towards poplar cultivation, it can conservatively be projected that about 0.15 million ha area in traditional poplar cultivation zone and 0.05 million ha area in other parts of the country will be under poplar cultivation in the next 10 years.

Genetic Base and Improvement:

About 90 percent of the poplar plantations in India are based on clones G-48, D-121, S7C15 and G-3. The yield of clone G-3, which once used to be the most popular clone, is declining due to attack by leaf blight disease. This clone is giving way to other clones, e.g., S7C8, Uday, L-34/82 etc. Individual plantations are, however, monoclonal (Kumar *et al*, 1998).

To increase the productivity of poplar, FRI Dehradun started a National Poplar Improvement Programme in 1997. Salient achievements of this initiative are:

(i) Clones of poplar introduced in India since late-1950 were ranked on the basis of volume growth. Clones S7C8, 82-35-4 and 113324 were found to give higher yield than G-48, presently one of the most popular clones in agroforestry plantations. Based on these rankings, a vegetative multiplication garden was established at FRI, Dehradun to supply cuttings of superior clones to growers.

(ii) Multilocation field trials of best 60 clones of previous introduction have been established at about 30 sites throughout the traditional as well as potential zones of poplar cultivation covering Jammu and Kashmir, Himachal Pradesh, Punjab, Haryana, Uttar Pradesh, Bihar, West Bengal, Orissa, Chhattisgarh, Maharashtra, Gujarat, etc. Fifteen Research Institutions comprising Universities, State Forest Departments are collaborating with FRI, Dehradun in this programme.

(iii) Intraspecific hybridisation amongst best 40 clones has been carried out. 289 clones from control-pollination and 111 clones from open-pollination have been selected for field trials.

(iv) Seed from 104 candidate plus trees growing in 44 natural stands in the USA has been brought to FRI Dehradun. 100 clones have been selected out of the new germplasm for further trials (Singh *et al*, 2003).

(v) A new approach of multi-step selection and concurrent multiplication has been developed at FRI Dehradun which enables multiplication of germplasm of superior clones at 2 years of age while clonal trial is still underway. This reduces the time period in clonal testing and multiplication process by 4 years (Kumar and Singh, 2000).

(vi) Hybrid seedlings of *P. deltoides* 'G-48' x *P. euphratica* have been produced to combine the rapid growth of *P. deltoides* and stress tolerance of *P. euphratica* (Singh *et al*, 2003).

WIMCO Seedling Ltd. has got registered 6 new clones- WSL-22, WSL-27, WSL-32, WSL-39, WSL-A26 and WSL-A49 with the International Poplar Commission, Italy during 2000. Uttar Pradesh (now Uttaranchal) Forest Department has identified more than 20 new clones that give significantly higher yield than conventionally planted clones.

As more of these new clones are deployed, productivity of poplar plantations will increase further.

Utilisation:

Exotic poplars were initially introduced in India to meet the needs of match industry. Later, poplar wood began to be used extensively in making plywood. The plywood industry many years back dwarfed the match industry as biggest consumer of poplar wood. Poplar veneers are not suitable for classification as Type A surface (Bansal, 1999). Hence poplar veneers in plywood industry are used only as core and cross band veneers. Face veneers are made of other species which are usually imported from abroad or procured from North-Eastern States of India. The pruned branches and roots of poplar are used for making charcoal. Unlike developed countries, use of poplar in paper making is still very small in India.

A survey of Yamunanagar area in Haryana where about three-fourths of all poplar wood produced in India is consumed, revealed that total demand of poplar wood in this area is 3439 tonne/day while the supply is only 1521 tonne/day suggesting a deficit of 1918tonne/day. The area has one parer indus!ry (Ballarpur Indus!ry Ltd., Yamunanagar) and about 300 plywood industries.

Some important statistics (Gautarn, 2000) about Ballarpur Industry Ltd., Yarnunagar afe as follows:

Wood consumption potential:	650 tonne/day
Wood consumption at time of survey:	561-616 tonne/day

Sources of raw material:

Poplar logs	21.2 tonne/day
Poplar waste from plywood industry	252.6 tonne/day
Eucalyptus	175.8 tonne/day
Bamboos	105.8 tonne/day
Hardwood scrap	48.0 tonne/day

Thus about 45 percent of wood requirement of Ballarpur Industry Ltd., Yamunanagar for making paper is met from poplar. But taking into consideration paper as well as plywood industries, only 18 per cent of poplar wood is consumed in paper making and the remaining 82 per cent of poplar wood in Yamunanagar market goes to plywood industries (Gautam, 2000).

Data about other places are not available but is expected that in India as a whole about 80 percent of poplar wood must be going to plywood industry. Of the remaining 20 percent, the major part would be going to match industry. Supply to pulp and charcoal units is very small.

Figures about percentage share of poplar based plywood in total plywood production of India are not available.

Marketing and Economics:

Poplar wood is sold by weight. The average prices of poplar wood during the previous three years were Rs. 350/quintal (>25" mid-girth), Rs. 200/ quintal (10-25" mid- girth) and Rs. 80/quintal (<10" mid- girth) (note: 1 US\$ = Rs. 47 approx). During the last one year, the prices of best quality wood have shrunk to about Rs. 200/quintal. Lower classes of logs have also suffered fall in price. The price of branches and roots is Rs. 35/quintal and Rs. 25/quintal respectively.

Farmers are earning handsome profits from nursery as well as plantation activities. Profits to the tune of 38.8 percent and 100.9 percent of investments are reported from rising of nursery stock within one year (Singh and Vashista, 2001). Benefit: cost ratio of 1.92:1 and 2.13:1 have been estimated with pure poplar and with poplar + intercropping in a pay-back period of 7 years (Dhillon et al, 2001).

Owing to very little risks and high profits in poplar cultivation, large farmers and absentee land-lords prefer to put their lands under poplar-based agroforestry rather than other agriculture/agroforestry options.

Plant Protection:

The major insect damaging poplar plantations is the stem borer. Control measures are available to control this pest. However, genetic variation in resistance of poplar clones to this pest has not been noted so far. Damages by defoliators have also been noted. Clonal variation in defoliator attacks has been found (Singh, 2002) and can be used for reducing damage to future poplar plantations.

Among diseases, leafblight caused by *Bipolaris maydis* is the most serious disease. However, it affects only clone G-3. The cultivation of G-3 in the affected areas has been stopped.

Damage by *Melampsora larici-populina*, *M populnea*, *Xanthomonas populi*, *Septoria populi*, *Pollaccia elegans*, etc. have been recorded but not in a severe form.

Policy and Institutional Issues:

- There are no restrictions on growing, felling and transportation of poplar trees of exotic species. However, there is need to extensively review policy, rules and regulations in respect of indigenous poplar and to relax the same with a view to encouraging their plantations.
- Institutional support is required to promote cultivation of poplar and establishment of poplar based industries in areas outside the natural zone of poplar.
- There is no regulatory mechanism to ensure supply of certified nursery stock to the growers. Some kind of certification mechanism is required to be put in place to check sale of physically or genetically inferior stock to the growers.
- Unlike agricultural crops, facility of minimum support price for wood of poplar, or any other agroforestry species, is not provided by the government. This leads to exploitation of growers. The fall in price of poplar wood during the past one year has significantly reduced the interest of farmers in poplar cultivation. Some poplar growers are now turning towards *Eucalyptus*. Poplar cultivation in India had become popular only due to buy-back guarantee given by WIMCO in the early stages of their programme for expansion of poplar farming. Similar mechanisms or other institutional measures for assuring a minimum price to the growers are required.
- Providing facility of credit and insurance as is available in case of traditional agricultural crops needs to be extended to cover tree cropping.
- Flow of research grants from users (industries, farmers, forest corporations) to research institutions is absent and the same needs to be initiated. This is in vogue in agriculture sector in India since long.

References

- Bansal, A.K., Narayanprasad, T.N. and Mathews, K.C. 1999. Plywood from plantation species - *populus deltoides* (poplar). Paper presented in National Seminar on Poplar at FRI Dehradun. Nov. 25-27, 1999.
- Chandra, J.P. 2001. Scope of poplar cultivation. *Indian Forester*. 127 (1): 51-60. Dhillon, A.; Sangwan, V.; Malik, D.P. and Luhach, M.S. 2001. An economic analysis of poplar cultivation. *Indian Forester*. 127(1): 86-90.
- Handa, A.K., Thakur, S., and khurara. 2000. Isozyme banding in *Populus ciliate x P. maximowiczii* hybrids. *Indian J. Forestry*. 23: 75-77.
- Jha, K.K. and Kumar, Y. 2000. Interspecific hybridisation in poplars and initial performance of hybrids in tatal of Uttar Pradesh. *Indian Journal of Forestry*. 23: I-II.
- Kumar D. and Singh N.B. 2001. Age-age correlation for early selection of clones of *Populus* in India. *Silvae Genetica*. 50 (3-4): 103-108
- Kumar D., Singh N.B., Rawat G.S., Srivastava S.K. and Mohan D. 1999. Improvement of *Populus deltoides* Bartr. ex Marsh in India - I. Present Status. *Indian Forester*. 125 (3): 245-263
- Land, S.B., Jr. 1996. Consultant report: Forest regeneration / tree improvement of poplars in India, July 1996. Forestry Research, Education and Extension Project, ICFRE Dehradun. 46 p.
- Seth, S.K. 1969. Poplar trials in Uttar Pradesh. U.P. Forest Forest Bull. No. 34. Forest Deptt., Uttar Pradesh. 106 p.
- Sharma, A.; Dwivedi, B.N.; Singh, B. and Kumar, K. 1999. Introduction of *Populus euphratica* in Indian semi-arid trans-Gangetic plains. *Annals of Forestry*. 7(1): 1-8.
- Singh, A.P. 2002. Final Progress Report on Plan Project on screening of poplar clones for resistance to leaf defoliators. Forest Entomology Division, Forest Research Institute, Dehradun.
- Singh N.B., Kumar D., Gupta R, Pundir I. and Tornar, A. 2002. Intraspecific and interspecific hybridization in poplar for production of new clones. *ENVIS Forestry Bulletin*. 2(2): 11-16