

EFFECT OF VARIOUS FACTORS ON ROOTING OF POPLARS IN PAKISTAN.

by

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Summary. When poplars were introduced in Pakistan about a decade back, emphasis was placed on only one clone viz. *p. euramericana* cv-'I-214' due to its intrinsic qualities of almost cent per cent rooting and fast rate of growth. Subsequently, some *deltoides* clones were also imported which showed comparatively better rate of growth but low rooting capability, prohibiting their large scale planting. Experiments were undertaken both with cuttings as well as entire plants exposing them to a number of treatments such as time of planting, different rooting media, frequency of irrigation and position of cutting on the plant etc. and using clones like *p. deltoides* 63/51, 90/60, 69/55 and 18/62, *p. euramericana* CV-I-214 being the control. Indications in both the cases were that supported by adequate winter rains or artificial irrigation and an efficient planting schedule, February was the best month for planting of most of the clones of poplar in the country.

1. Introduction. Cultivation of poplars is becoming quite important to the growth and development of wood based industries in West Pakistan due to extra-ordinary qualities of the tree like fast rate of growth and the scope for utilisation of its wood for multifarious purposes. As compared to the indigenous species at present growing in the natural and man made forests, two to three times more wood can be anticipated from well looked after poplar plantations over a period of only ten to twelve years. Expansion of areas under poplar cultivation demands an increase in the number of poplar clones capable of adapting to varied and difficult ecological conditions obtaining in the country. In the case of Euramerican hybrids, it is possible to get almost cent per cent rooting yet various clones of *F. deltoides*, although better in rate of growth, have shown poor rootability, to the extent that planting results have given only 30-40 percent success. Study of the factors influencing rooting is, therefore, of particular importance in view of the proposed large scale planting programme.

2. Literature Reviewed. No work has been done on the problem of rooting of poplars in Indo-Pakistan sub-continent, the reason being that the importance of introducing poplars in these regions was felt very recently. As a result of that, work on the genetical behaviour or physiological changes in the roots of various species and clones of this tree did not get much attention.

For the purposes of selection, breeding and clonal propagation, it is of utmost importance that species or its hybrids should easily propagate by vegetative means *i. e.*, by

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cuttings and, therefore, easy rooting is a quality to be given a very high importance. The problem is being given so much attention in the poplar culture of the Mediterranean countries that while making selection in the clonal population, rooting ability is very significant factor to be reckoned with.

A lot of research and study work has been done in most of the poplar growing countries of Europe. In Italy, where selection and breeding work has been done over the past 30-40 years, the problem of rooting was studied in detail. A team of research workers headed by Professor A. De. phillips, Director, Agriculture and Forest Institute, Rome, carried out extensive study on this problem on various lines. He made biochemical studies on the auxins, inhibitors and Amino acids in the cuttings of *P. deltoides* 63/51, 77/51, *Euramericana* cv-I-214 and many other clones of *P. deltoides* and *P. alba* etc. which had particular difficulty in rooting. Examination of root extract, paper chromatography and coleoptile tests revealed the presence of Indole-3-acetic acid. Also variation in the inhibitory contents of roots decreased according to the time of analysis. The dormant cuttings had a high percentage of inhibitory material which decreased appreciably during the development of bud and rooting process. These researchers also found that total amino-nitrogen content decreased progressively in *P. deltoides* 63/51, *P. deltoides* 77/51 and *P. euramericana* cv. 'I-214'. Also according to the time of planting in the nursery, amino-nitrogen content decreased from S2-R3 to S₁R₁ (S = Shoot, R = Root.)

The anatomical and morphological study on various clones revealed that there was difference in fibrous growth and in the development of root primordia according to the genetic behaviour in well and poorly rooting clones. The workers are, however, of the opinion that anatomical characters were not determining factors in the rooting process of *P. deltoides*. According to them, rooting ability was influenced more by physiological and environmental factors, such as time, light and constant temperature etc. as compared to anatomical features.

The trials conducted by Italian research workers in the field with and without auxin treatment of the cuttings indicated that genetic features and an appropriate substrata were two determining factors in the rooting process. Trials were, therefore, conducted with different types of soil, light, temperature moisture, etc.

Nutritional experiments with different fertilizers were also carried out which indicated a fair amount of influence on the rooting process in various clones by different fertilizers and their combinations. The influence of plant's age gave some contradictory results and, therefore, further research and study was desirable in the light of specific environment, quite different from the origin of the individuals used. On the above lines, work has also been carried out in Switzerland, France, Belgium and Germany.

Very definite results have not so far been obtained inspite of extensive work on this problem in many countries.

3. Materials and Methods.

A. Cuttings

An experiment to see the effect of different treatments on rooting behaviour of poplars was initiated during 1972, using the cuttings of the following clones:

- (i) *Populus deltoides* cv. 'I-63/51'
- (ii) *Populus deltoides* cv. 'I-69/55'
- (iii) *Populus deltoides* cv. 'I-72/51'—(used only in one treatment).
- (iv) *Populus deltoides* cv. 'I-18/62'
- (v) *Populus deltoides* cv. 'I-90/60'
- (vi) *Populus euramericana* cv. 'I-214'

There is no problem with rooting of *P. euramericana* and this clone was used only as control.

Following factors were investigated :

- (a) Effect of sub-strata,
 - i. Sand
 - ii. Sandy loam
 - iii. Clay loam
- (b) Effect of position of cuttings on the plant.
 - i. Root shoot
 - ii. First cutting from the base ; and
 - iii. Second cutting from the base end.
- (c) Effect of coating the tips of cutting with wax
 - i. Coating
 - ii. No coating
- (d) Effect of frequency of irrigation
 - i. Weekly.
 - ii. Fortnightly.
- (e) Effect of season of planting. January to March.

Effect of root promoting hormones could not be studied due to their non-availability.

Planting stock to study the effect of first four factors was procured from Forest Research Station, Jallo and experiment laid out on 6th February, 1972 in the Silvicultural Research Garden Peshawar.

Cuttings to see the effect of the 5th factor i. e., season of planting were obtained from the second stage nursery in the Silvicultural Research Garden, and planted

on 25th January, 1972. The planting was repeated at week's interval on 1st February, 8th February, 15th February, 22nd February, 29th February, 7th March and 14th March, 1972,

The experiment was laid out in randomised block design using 3 replications. The unit of replication consisted of a row of 5 cuttings. The planting of cuttings was done at 3x3 ft. spacings in well prepared plots except in case of first treatment where these were planted in earthen pots filled with sub-strata of desired composition. Irrigation was applied once a week except in case of 4th factor which had a partially different schedule.

The time of commencement and completion of sprouting of cuttings in all the treatments was observed and recorded. Percentage of cuttings sprouted was also calculated after 3 months of planting to compare the effect of various factors.

4. Results and discussion.

1. Effect of sub-strata

Clone	No. of cuttings sprouted out of 15		
	Sand	Sand/loam	Clay loam
'I-63/51'	13	11	15
'I-69/55'	14	8	13
'I-18/62'	11	10	9
'I-90/60'	14	14	13
'I-I-214'	15	15	14

- i. Maximum sprouting in all the clones except 63/51 was in sand; 'I-63/51' gave cent percent sprouting in clay loam only.
- ii. Clone 18/62 gave consistently poor sprouting in all media and 'I-214' gave good results, irrespective of the type of soil.

2. Effect of position of cutting on the plant.

Clone	No. of cuttings sprouted out of 15		
	Root shoot	1st cutting from the base	Second cutting from the base.
'I-63/51'	15	15	14
'I-69/55'	15	15	14
'I-18/62'	15	14	14
'I-90/60'	15	15	15
'I-214'	15	15	15

Root-shoot cuttings gave the best results followed by first cutting from the base and second cutting from the base. This means that the rootability of cuttings goes on decreasing with the distance from the base.

3. Effect of coating the tips of cuttings with wax.

	No. of cuttings sprouted out of 15	
	Coated	Non-coated
'I-63/51'	11	14
'I-69/55'	10	12
'I-18/62'	11	14
'I-90/60'	15	15
'I-214'	15	15

Coating of tips of cuttings does not seem to have any effect on their rooting. On the other hand, improper handling at the time of coating or decoating could damage the cutting. A coat of wax would be more useful when carriage over longer distance over a period of time is involved.

4. Effect of frequency of irrigation

Clone		No. of cuttings sprouted out of 15	
		Weekly	Fortnightly
'I-63/51'	--	13	12
'I-69/55'	--	14	12
'I-18/62'	--	13	15
'I-90/60'	--	14	13
'I-214'	--	15	15

Whereas frequency of irrigation have had no effect in the case of 'I-214', there was more sprouting in other clones under weekly irrigation rather than fortnightly except 18/62. The difference due to frequency of irrigation could not be considered very indicative as lot of rain was received during that period.

5. Effect of Season of Planting

Clone	Nuner of cuttings sprouted out of 15							
	25-1-72	1-2-72	8-2-72	15-2-72	22-2-72	29-2-72	7-3-72	14-3-72
'I-63/51'	7	7	5	9	14	13	10	9
'I-69/55	7	8	5	7	6	4	5	4
'I-72/51'	7	4	4	14	14	8	7	10
'I-18/62'	8	7	8	10	12	10	—	—
'I-90/60'	9	3	6	8	15	8	9	—
'I-214'	15	12	10	14	14	15	13	13

Out of 6 clones, 5 gave the maximum number of sprouting from 15th to 29th February. Only 69/55, which even otherwise was poor throughout, showed the best

sprouting in the 1st week of February. It can, therefore, be safely concluded that the best period for raising a Poplar nursery in Peshawar (Temperature and rainfall averages given) is the month of February.

6. Since as per recommended practices one to two year old second stage nursery plants of poplars are used for field planting, the study was repeated in February, 1973 using one year old plants. However, only planting time and irrigation were considered the most important factors and the rest of the treatments were ignored. Silvicultural Research Garden No. 1, Peshawar and Tazadin, which lies within 12 miles radius of Peshawar were selected for planting out. Planting was done between February 10 and 12, in 2 ft. deep pits. Special care was taken to finish the planting the same day the plants were taken out from the nursery.

Details are as under :

Name of the species and clones number		No. of plants planted.	Remarks.	
P. euramericana cv-I-214		900	There was 100% sprouting by the last week of March except 63/51 which completed sprouting as late as second week of April. 'I-214' sprouted earlier than the deltoides.	
P. deltoides	'I-90/60'	50		
	'I-18/62'	150		
"	"	'I-69/55'		50
"	"	'I-63/51'		50
"	"	'I-72/51'		50

In all the five clones there was luckily hundred percent sprouting which is attributable to the following factors:

1. Good winter rains following field plantation.
2. Proper care during and after planting in the form of ramming of soil, irrigation etc.
3. Lapse of minimum possible time between uprooting and field planting.

7. Conclusion.

Both the experiments show that February is the best time for raising nurseries as well as plantations. Also if proper care is taken during and after planting even the deltoides clones which are notorious for low rootability show an improvement in this regard, enhancing the chances of their success. An important factor leading to the success or failure of poorly-rooting clones is that root formation in the new site must precede sprouting of leaf buds so that when leafing starts, root system is already in a position to support the growth effort of the plant by drawing upon soil nutrients and water.

APPENDIX

Mean monthly maximum and minimum temperature and precipitation for Peshawar

Latitude : 34° 01' N.
 Longitude : 71° 34' E.
 Altitude : 1161 ft.

	Jan.	Feb.	March	April	May	June	July	August	Sept.	October	Nov.	Dec.	year
Max. temp. F°	63.0	66.2	74.0	85.2	97.0	105.0	102.5	98.2	95.05	87.0	76.8	66.7	85.0
Min. temp. F°	40.4	44.0	52.4	60.5	70.4	77.2	80.2	78.9	71.8	60.5	48.9	40.9	60.5
Precipitation (Inches).	1.44	1.53	2.44	0.75	0.77	0.31	1.26	2.03	0.81	0.23	0.31	0.67	13.65