

NURSERY AND FIELD PLANTING TECHNIQUES OF CHIR PINE (*PINUS ROXBURGHII*)

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Introduction: Although raising of chir pine in polythene tubes and its planting out was started quite a few years back, the methods adopted in actual practice left much to be desired. Under the Hazara Preinvestment Project, World Bank authorities desired that in view of the extensive planting programme involved in the project it would be better if these practices were standardized for the benefit of the field foresters. The job was assigned to the Pakistan Forest Institute.

A. Nursery Techniques: It was proposed to start the nursery at Dudial on Mansehra-Shinkiari road in the newly purchased land for the project. Layout, provision of water supply and other materials was discussed at site. Study plans for different experiments were prepared. It was possible to start the work in the last week of May 1979. Experiments were laid out to study the growth behaviour of chir pine seedlings in different soil mixture and soil fraction; effect of fertilizers; suitable type of containers the best season for sowing the seed; and to find out optimum water regime for quick germination and growth.

1. *Effect of soil mixture on the growth of seedlings.* Chir pine seed was sown on 25th May, 1979 in polythene tubes of size 7.5 x 8 cm with 40 perforations, filled with medium comprising various proportions of garden soil, sand and humus. Seed of two seed sources, Gidarpur and Baz Khan, was sown, with one seed to each tube. Tubes were watered twice a day with a fine rose during June and part of July. Subsequently as the monsoon started frequency of watering was reduced to once a day when it did not rain.

The results of growth measurements taken on 4-4-1980 and 21-8-1980 are as follows:

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Table 1

Effect of soil mixture in polythene tubes on the growth of chir pine seedlings

Proportion of soil, sand, humus (Volume)		Average height of seedling (cm)			
		Baz Khan seed source/Gidarpur seed source			
		4-4-80	21-8-80	4-4-80	21-8-80
A	0 : 50 : 50	8.6	18.9	9.0	18.2
B	50 : 50 : 0	9.7	19.5	9.6	17.3
C	50 : 0 : 50	9.0	17.1	9.4	17.0
D	100 : 0 : 0	9.3	17.2	8.8	19.7
E	0 : 100 : 0	7.7	16.3	9.0	17.6
F	0 : 0 : 100	10.1	18.0	9.6	18.9

Results are not significant.

In addition to above some other mixture such as 6 : 2 : 2 (soil, and, humus) and 6 : 1 : 2 were also tested. 6 : 1 : 2 gave good results and was recommended for adoption in the field. Larger proportion of soil is necessary to hold the root system together when the polythene tube is removed before planting out.

2. *Effect of soil fractions.* The seed was sown on 25th May, 1979 in polythene tubes filled with different sand and soil fractions. Seed of 2 seed sources, Gidarpur and Baz Khan was sown to one seed in each polythene (7.5 x 18 cm) tube. Tubes were watered twice a day with a fine rose during June and part of July. Frequency of watering was reduced with the set of monsoons. The results of growth measurements taken on 4-4-1980 and 21-8-1980 are as follows:

Table 2

Effect of soil fractions in polythene tubes on the growth of chir pine seedlings

Fraction of sand and soil (volume)		Average height of seedlings (cm)			
		4-4-80	21-8-80	4-4-80	21-8-80
A	80 : 20	9.8	18.6	9.0	15.2
B	20 : 80	9.8	20.5	10.2	18.3
C	75 : 25	9.8	20.0	10.1	16.5
D	25 : 75	9.0	20.7	10.4	20.7
E	60 : 40	9.9	21.0	9.7	17.8
F	40 : 60	9.5	18.8	9.6	17.2

Results are non significant. 25 : 75 sand soil mixture gave the best over all results. It is recommended for use in the polythene tubes if humus is not available.

3. *Effect of fertilizer.* A factorial experiment was started on 1-5-1979 at Pakistan Forest Institute to study the effect of NPK fertilizers in all possible combinations on the shoot growth of chir pine seedlings raised in polythene bags of 7.5 x 18 cm size. To avoid the leaching of fertilizer through punch holes in polythene bags, each was placed in an unpunched bag. The fertilizer dose comprised: N as 60 mg urea, P as 212 mg superphosphate, K as 30 mg potassium sulphate. The fertilizer were applied in solution as a single dose. The following measurements were recorded on 1-12-1979:

Table 3

Effect of NPK fertilizers on the growth of Pinus roxburghii

Treatments	Av. shoot diameter at collar (cm)	Av. shoot length (cm)	Av. shoot weight (gm)
N ₀ P ₀ K ₀	0.3	3	20
N ₁ P ₀ K ₀	0.4	6	28
N ₀ P ₁ K ₀	0.5	8	30
N ₁ P ₁ K ₀	0.5	9	34
N ₀ P ₀ K ₁	0.3	3	24
N ₁ P ₀ K ₁	0.4	8	30
N ₀ P ₁ K ₁	0.5	9	34
N ₁ P ₁ K ₁	0.6	14	46

Results and discussion: Statistical analysis has shown that fertilization has a significant effect on all the parameters indicated in Table-1. The analysis of individual treatments revealed that the highest effect was exhibited by phosphorus followed by nitrogen whereas potash produced the lowest responses. The data further indicated that the treatment interactions effects are also highly significant. Since the rate of growth is directly proportional to the quantity of fertilizer added, higher doses of the NPK will be tested in the future experiments.

4. *Effect of size and closed and open bottom polythene tubes on the growth of chir pine seedlings.* Chir pine seed from Gidarpur source was sown on 15th July, 1979 in polythene tubes of various sizes filled with 6 : 1 : 2 soil, sand and humus mixture by volume. The experiment was designed in randomise complete block design with 5 replications and 100 tubes to each treatment. One seed was sown in each tube. Tubes were watered twice a day with a fine rose

till the rains started. The experiment was assessed on April 4, 1980. The results were as follows:

Table 4

Effect of size of closed and open bottom polythene containers on the survival and growth of chir pine seedlings

Size (cm)	Replications			
	Average	Survival, %	Average	Height, (cm)
	Bottom closed	Bottom open	Bottom closed	Bottom open
6 x 15	53	43	9.9	10.3
6 x 18	54	44	9.8	10.2
8 x 18	60	48	10.1	10.4
10 x 18	61	52	9.7	10.6
10 x 20	61	61	9.7	10.6

Neither survival nor height of seedlings was significantly affected by any of the above treatments. From economy point of view as well as considering the case in transportation of the stock 8 x 18 cm size is recommended for use.

5. *Effect of frequency of watering on survival and height growth.* Seed from Baz Khan seed source was sown on 10th June, 1979 in polythene tubes of size 7.5 x 18 cm with 40 perforations filled with soil : sand : humus, in 6 : 1 : 2 ratio. Water was applied with rose can till the tubes were thoroughly soaked at the following frequencies:

Twice a day	8 a.m. and 4 p.m.
Once a day	8 a.m.
On alternate day	8 a.m.
After two days	8 a.m.

The experiment was designed in a randomised complete block design with 5 replications and 100 tubes to each treatment. The experiment was assessed in July for survival and in April, 1980 for height.

The results are as follows:

Table 5

Effect of frequency of watering on survival and growth of seedlings

Watering Frequency	Replications					Average
	1	2	3	4	5	
Survival (%)						
Twice a day	65	64	61	60	56	61
Once a day	58	78	58	60	64	63
Alternate days	66	66	66	51	57	61
After 2 days	55	51	52	53	55	53
Average height (cm)						
Twice a day	9.8	11.2	11.1	11.0	12.1	15.1
Once a day	8.9	10.7	11.3	10.8	12.4	14.8
Alternate days	9.2	12.4	10.5	9.6	10.2	13.4
After 2 days	8.4	10.8	9.7	9.7	8.6	12.2

Minimum survival was shown when the seedlings were watered after two days; effect of the rest of the watering frequencies was almost the same. However, frequency of watering did have an effect on the growth of the seedling, the maximum being when watering was done twice a day, minimum in the case of watering after two days. These indications are significant at 1% level. It is recommended that if possible watering should be done twice a day to get a good rate of growth.

6. *Suitable time for raising chir pine stock.* Sowing in this case was done in May, July and October, 1979. Whereas survival after germination was 52% in May, survival in monsoon was about 80% and survival in October sowing was about 90%. It is, therefore concluded that maximum sowing should be done from August to October. Late spring sowing is adversely affected due to the heat of May and June.

B. *Field planting:* 1. *Methods of ground preparation.* To find out how far different methods of ground preparation employed for field planting of chir pine would help its survival and growth, 1-year old chir pine seedlings from 2 different provenances viz. Batrasi and Baz Khan were planted in Dudhial in August 1979, using 25 cm deep pit (M-1), 30 cm deep pit (M-2) and holes made by crow-bar (M-3). In all 288 plants were used. Survival on March, 1981 was recorded as under:

Treatment	Survival on March 1981	
	Batrasi (%)	Baz Khan (%)
M-1 : 25 cm deep pit	63	62
M-2 : 30 cm deep pit	61	58
M-3 : hole made by crow bar	59	55

The data were analysed and it was found that there was no significant difference in the method of ground preparation. The same experiment was repeated at Batrasi with almost the same indication.

It is, therefore, recommended that when planting 1-year old chir pine in polythene tubes, 25 cm deep pits is enough provided the tube length is 20 cm.

2. *Survival of root pruned, bare rooted plants.* To compare the survival and rate of growth of root pruned, unpruned and tube plants of chir pine in the field, 2-year old seedlings of chir pine raised in Nawanshehr nursery were planted at Dhodial and Batrasi in July 1980. Planting was done at a spacing of 1 x 1 m in 5 replications using 540 plants in all. Following results were obtained in April 1981.

Survival on 9-4-1981, 180 plants under each treatment

Treatment	Locality	
	Batrasi	Dhodial
A = Chir pine unpruned	2	3
B = Chir pine pruned	0	0
C = Tube plants	155	160

It has been confirmed that it is no use trying to plant bare rooted, root pruned or unpruned stock of chir pine in the field and only tube plants should be planted out to achieve a good survival.

3. *Season of planting.* To find out the best season of planting chir pine, 1-year old tube plants of 2 different localities i.e., Batrasi and Baz Khan were planted at Dhodial, in monsoon and winter of 1979 and spring of 1980 in 4

replications. In all 864 plants were used at a spacing of 1 x 1 m. Following percentage of survival was recorded:

Survival percentage in April 1981

Treatment	Locality	
	Gidderpur	Baz Khan
S-1 = Monsoon planting	78	71
S-2 = Winter planting	61	58
S-3 = Spring planting	43	41

It has been found that monsoon planting gives the best results and it is, therefore, recommended for field planting. Spring planting gave the lowest survival due to hot months of May and June before the rainfall.

4. *Effect of weeding.* To find out whether weeding would help survival and growth of chir pine seedlings, 1-year old chir pine stock in polythene tubes from 2 different provenances namely Batrasi and Baz Khan were planted at Dhodial during monsoon, 1979 at 2 x 2 m spacing, and 480 plants in all. Split plot design was adopted using 5 weeding methods. Survival on 9-4-1981 were as under:

	Batrasi					Baz Khan				
	Spot		Strip		No weeding	Spot		Strip		No weeding
	Once	Twice	Once	Twice	—	Once	Twice	Once	Twice	—
R-I	10	12	14	9	9	9	10	11	12	6
R-II	11	10	12	9	11	12	13	11	7	10
R-III	8	9	10	7	8	8	8	9	10	9
Total:	29	31	36	25	28	29	31	31	29	25

Statistically there is no significant difference in survival although there was comparatively low survival where no weeding was done. It is recommended

that if there is very heavy weed growth in the area where planting is to be done, weeds should be removed before planting to reduce competition.

5. *Age of the planting stock.* In an earlier study comparing relative merits of sowing, and planting 18, 24 and 36 months old nursery stock in polythene tubes, it has been established that depending on its rate of growth in the nursery, 18-24 months old nursery stock gives the best survival and subsequent growth and is, therefore, recommended for large scale afforestation.

6. *Comparison of rate of growth with Slash pine.* To compare the rate of growth of chir pine with Slash pine (*Pinus elliottii*) 1-year old seedlings of both the species were planted at Dhodhial in July, 1980 at a spacing 1 x 1 m in 5 replications using 470 plants of each of the pine species. *Amorpha fruticosa* which is a leguminous plant and is likely to help the growth of pines was also planted at 0.5 m from the pine seedlings. In all 1560 plants were used. The following survival was recorded in April 1981:

Treatment	No. of plants surviving out of 180
A — Chir pine	160
B — Chir pine and Amorpha	151
C — Slash pine	165
D — Slash pine and Amorpha	169

Average height of slash pine plants was better than chir pine, the difference being about 8 cm.

7. *Comparison of rate of growth with Pinus radiata and Pinus elderica.* The study was planted in Dhodial in July 1980 using three species i.e., *Pinus roxburghii*, *Pinus elderica* and *Pinus radiata* in randomised complete block design, in 4 replications at 2 x 2, with 25 plants in each sub-plot.

Data recorded in June 1981 gave the following results:

	<i>Pinus radiata</i>	<i>Pinus roxburghii</i>	<i>Pinus elderica</i>
R I	14	7	2
R II	15	8	1
R III	8	2	—
R IV	1	5	—
	39	22	3

It is indicated that *Pinus elderica* is not the species for this area. *Pinus radiata* has performed better than *Pinus roxburghii*.

8. *Effect of spacing.* To study the effect of different spacing on the survival and growth of chir pine plants, one and a half year old chir pine seedlings of one provenance viz. Gidderpur were planted in Dhodhial. Treatments used were 5 x 5, 6 x 6, 7 x 7, 8 x 8 and 9 x 9 feet spacing, planting 324, 256, 196, 144 and 100 plants respectively. Following data were recorded in April, 1981:

Replication	Spacing				
	5 x 5	6 x 6	7 x 7	8 x 8	9 x 9
R-I	72	51	31	22	11
R-II	65	49	28	13	13
R-III	59	43	26	16	15
R-IV	44	39	32	19	10
Total:	240	186	117	70	49

Spacing effect was not much pronounced at this stage but survival decreased with increase in spacing.

9. *Effect of fertilizer.* In order to find out the effect of NPK alone and in combination, 8-year old chir crop planted on private land at 3 x 3 m by Forest Department near Balakot was given different doses of fertilizer in August 1979. 500 gm of urea, 600 gm of SSP, and 500 gm of Potassium sulphate was given to individual trees as a basic dose.

Single tree constitutes one treatment with one tree as control. So the design used was paired replicates with 7 treatments and 5 replications. The soil was thoroughly worked around the base of each tree in a circle of 1 m radius. Lower branches were pruned. The fertilizer was then added and mixed thoroughly in the soil. After mixing the fertilizer, the plants were numbered. 1 represents application of fertilizer and (1) represents its unfertilized counterpart. Thus each replication with seven treatments had 14 plants — 7 treated and 7 untreated.

Data were recorded in 1981. The trees have not shown the effect of fertilization so far.

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