

DEPTH OF IRRIGATION AFFECTS VOLUME PRODUCTION IN TREE SPECIES

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SUMMARY

Canal water is a very valuable commodity in Pakistan. For the last 100 years or so, irrigated plantations are being raised in Pakistan for fuel wood and timber. Except for Shisham (*Dalbergia sissoo*), the quantity of water required by different tree species for their survival and optimum growth has not been known. A study was started in Chichawatni plantation to ascertain the effect of three deltas of water viz. 3, 4.5 and 6 feet on four species—*Eucalyptus camaldulensis*, *Bombax malabarica*, *Morus alba* and four exotic clones of poplars. It was found that there was almost linear relationship between the depths of water applied and volume.

Introduction

The irrigated plantations in Pakistan owe their survival to the canal water supply which is a precious commodity and, therefore, has to be utilized as economically as possible. In fact, the most important job of a forester in an irrigated plantation is to devise ways and means to establish the optimum dose of water for the species being raised there so that whatever is surplus can be spared for use by the farmers. Water supply situation is quite precarious and as more and more areas are being brought under the plough, the competition for water between food crops and trees is growing. The construction of new barrages and the increased spread of irrigation network has undoubtedly brought more water to the country but side by side the demand for food, timber and firewood is also increasing and, therefore, competition for water would continue for a long time to come.

Currently emphasis is being placed on planting of quick growing species. *Eucalyptus camaldulensis*, *Salmaia malabarica* and *Acacia arabica* and poplars are considered to be fairly quick in their rate of growth. It is, however, not known as to the quantity of water they actually require for their sustenance and growth. A study has been conducted with a view to determining the optimum water requirement of all these species so that while planted on a large scale they are neither starved of water nor they receive it in excess of their requirements.

The four species and the intensities of irrigation with the deltas of 3, 4.5 and 6 feet were kept as variables (D_1 , D_2 , D_3) on fortnightly irrigation.

Review of past work

The importance of conservation of irrigation water and need to find the optimum water requirements of principal species have been the subject of research studies in the Past. Chopra (1) conducted experiments at Chichawatni to determine the water requirements of Shisham

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around each plant it could not save the crop from frost damage. Subsequently castor was planted which was quite useful.

In view of the increasing demand for poplar wood in the country it was decided to include this tree as the fourth species at Chichawatni. Accordingly an area of 2.2 hectares contiguous to the rest of the area was taken from the Punjab Forest Department. The area was planted on 10.2.1978 with four deltoides clones viz. 72/58, 4/64, 69/55, 90/60, 960 cuttings of each clone were planted, 3840 in all. Another 15 plots were thus added bringing the total 60.

66 meter flumes were constructed and iron shutters provided to regulate the flow of water according to the prescribed deltas. Irrigation is being provided according schedule and diameter and height measurements are being taken, 16 trees out of total 256 of trees in the plot, one tree in each line.

First thinning

First thinning was considered necessary in 1981 as the crop appeared to be congested. Following steps were taken:

1. DBH of all the standing trees of all the four species were recorded with basal areas against each.
2. Each plot was then visited and trees required silviculturally to be thinned out in addition to dead, dying diseased, top broken or of defective stem form, were marked with white cross marks. The same trees were marked in the enumeration lists according to their serial numbers.
3. Total basal area of standing trees in each plot and the basal area thinned out were calculated. Percentage of the thinned and retained trees with respect to both number of standing trees and their basal area were also calculated. The actual thinning was then carried out.

Data in abstract form is given below:

Species	Number standing	Number of Trees			
		Number thinned	%	Number retained	%
Eucalyptus	3665	1758	48	1907	52
Mulberry	3031	1245	41	1786	59
Simal	2989	1202	40	1787	60
Poplar	3543	1218	34	2325	66

Species	Basal Area				
	B.A standing	B.A thinned	%	B.A retained	%
Eucalyptus	241.91	80.39	33	161.52	67
Mulberry	121.62	31.77	26	89.85	74
Simal	354.63	100.28	28	254.36	72
Poplar	258.78	59.66	23	199.12	77

The above data indicate *Eucalyptus camaldulensis* has grown almost as good as poplar but has not been able to compete with simul.

Analysis of data

A comparison of diameter, height and volumes under different deltas and in equal areas (1.14 acre/0.46 ha) is given below. The comparison has also been shown in histogram.

Delta	Diameter (cm)	Height (m)	Volumes (cft)	(m ³)
<i>Salmaaliala malabarica</i>				
1.	15.7	10.2	2057	57.6
2.	16.7	10.5	2386	66.8
3.	17.0	10.5	2321	65.0
<i>Eucalyptus camaldulensis</i>				
1.	11.6	15.9	1221	34.0
2.	11.7	16.5	1558	43.6
3.	12.2	17.1	1621	45.4
<i>Poplars</i>				
1.	11.7	14.4	1225	34.0
2.	11.6	14.4	1224	34.3
3.	11.7	14.4	1406	39.4

Morus alba

1.	9.9	8.1	596	16.7
2.	10.9	8.7	632	17.7
3.	10.6	8.7	603	16.9

Conclusion

The three depths of irrigation given to each species has definitely affected the volume production in semul, eucalypts and poplars.

1. In case of semul, the maximum volume production was achieved under 4.5' delta which is 329 cft of 14% more than 3' delta.
2. The eucalypt has shown maximum volume production under 6' delta which is 400 cft or 25% more than 3' delta.
3. The depth of irrigation has also affected poplar as difference of 181 cft or 13% of volume exists between 3' delta and 6' delta.
4. Mulberry has been least affected by the depths of irrigation.

There is almost linear relationship between the delta and the volume per unit area.

Acknowledgement

Authors are grateful to Mr. Hassan Abbas, Forest Mensuration Officer for conducting thinnings and analysis of data.

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APPENDIX

DISCHARGES AND TIME CHART FOR VARIOUS
DELTAS AND FREQUENCIES

*(Time is based on area of one plot 100' x 100' = 0.23
Acres and for one irrigation)*

Frequency				
Delta		D ₁ = 3'	D ₂ = 45'	D ₃ = 6'
Cusecs	Gauge	D ₁	D ₂	D ₃
1.5	.480	0-27-47	0-41-40	0-55-53
1.6	.505	0-26-02	0-39-04	0-52-05
1.7	.525	0-24-31	0-36-46	0-49-01
1.8	.545	0-23-09	0-34-43	0-46-18
1.9	.565	0-21-56	0-32-54	0-43-52
2.0	.585	0-20-50	0-31-15	0-41-40
2.1	.600	0-19-51	0-29-46	0-39-41
2.2	.620	0-18-56	0-28-25	0-37-53
2.3	.640	0-18-07	0-27-10	0-36-14
2.4	.660	0-17-22	0-26-03	0-34-43
2.5	.675	0-16-40	0-25-00	0-33-20
2.6	.695	0-16-02	0-24-02	0-32-03
2.7	.710	0-15-26	0-23-09	0-30-52
2.8	.730	0-14-53	0-22-19	0-29-46
2.9	.745	0-14-22	0-21-33	0-28-44
3.0	.765	0-13-53	0-20-50	0-27-47
3.1	.780	0-13-26	0-20-10	0-26-53
3.2	.795	0-13-01	0-19-32	0-26-02
3.3	.815	0-12-38	0-18-56	0-25-15
3.4	.839	0-12-15	0-18-23	0-24-30
3.5	.845	0-11-54	0-17-51	0-23-49
3.6	.860	0-11-34	0-17-22	0-23-09
3.7	.875	0-11-16	0-16-54	0-22-31
3.8	.895	0-10-58	0-16-27	0-21-56
3.9	.920	0-10-41	0-16-02	0-21-22
4.0	.925	0-10-25	0-15-38	0-20-50