

GROWTH CHARACTERISTICS OF TREES AND NUTRIENT STATUS OF SOIL ON THE AFFORESTED AND ADJOINING BARREN BANK OF MANASBAL LAKE, KASHMIR

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ABSTRACT

The study was carried out on the North-Western afforested bank of Manasbal Lake, Kashmir during the year 2007. During the course of study *Populus deltoides* recorded maximum average diameter, average height and basal area whereas the minimum average diameter, average height and basal area were recorded in *Cedrus deodara*. The soil analysis of the afforested site and the adjoining barren land revealed that soil reaction was approximately neutral in case of vegetation area but was mildly alkaline in barren land. However, vegetation area was comparatively superior in organic carbon, available nitrogen, available phosphorus, available potassium and moisture content than barren land.

Key words: Afforestation, Nutrient status, Manasbal lake, Soil

INTRODUCTION

Growth is the biological phenomenon of increase in size with time. It involves the formation, differentiation and expansion of new cells, tissues or organs. Growth does not take place throughout the whole length of the plant body but is localized in meristematic regions. The meristematic cells at the tip of shoot divide and elongate which causes the height growth in a shoot. The period of height growth in a year usually differs from species to species and with climatic conditions. Most of the species grow in height during March to September in north India. The rate of diameter growth is similar to that of height i.e. rate of growth is faster during early and middle ages but decreases at maturity. The diameter growth in a tree is affected by genetical constitution, site factors and density. Soil also plays an important role in the growth and development of trees. It provides moisture, nutrients and support vegetation. An attempt therefore has been made to study the growth characteristics of trees and status of nutrients like, available N, P and K along with organic carbon and moisture content on the afforested and adjoining barren bank of Manasbal lake, Kashmir.

MATERIALS AND METHODS

The afforested bank of Manasbal Lake is located at 70°-40' East longitude and 34°-15' North latitude at an elevation of 1,583 meters above sea level and is about 30 km North of Srinagar city. The maximum temperature of the study site touches as high as 31°C in the month of July whereas minimum temperature drops as low as -4°C in the month of January. The annual precipitation of the area is about 700 mm and most of the precipitation is received in the form of snow during winter months. The site is located on the North-Western bank of Manasbal Lake and was taken up for afforestation by the Faculty of Forestry, SKUAST-K in the year 1992 (Figure 1). During afforestation twelve

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tree species were planted in the area viz., *Acer negundo*, *Aesculus indica*, *Ailanthus altissima*, *Albizia julibrissin*, *Catalpa bignonioides*, *Cedrus deodara*, *Cupressus torulosa*, *Populus deltoides*, *Prunus armeniaca*, *Robinia pseudoacacia*, *Salix alba* and *Ulmus wallichiana*. In addition to these species *Celtis australis* and *Morus alba* were already existing there before afforestation. The area is about 1.6 km in length whereas its width ranges between 40-50 meters. After survey of the entire area, eight quadrats of size 10 x 10m for trees were laid out on either side of the base line in a staggered fashion after every 200 meters for growth parameters. The assessment of species diversity was done by listing all the plant species present within the quadrat of the study area and the identification of the species was confirmed by the experts. Diameter of trees was recorded by using diameter tape and height with Ravi's multimeter. Basal area was calculated by the formula:

$$\text{Basal area} = \frac{\pi d^2}{4} \quad \text{Where } d = \text{diameter at breast height}$$

The following standard procedures were used for analyzing pH, organic carbon, nutrient content and moisture content of soil:

pH	:	Digital pH meter (Jackson, 1957)
Organic carbon (%)	:	Walkey and Black (1934)
Available nitrogen (kg/ha)	:	Subbiah and Asija (1956)
Available phosphorus (kg/ha)	:	Olsen <i>et al.</i> (1954)
Available potassium (kg/ha)	:	Merwin and Peech (1951)
Moisture content (%)	:	Black (1965)



Fig. 1. A view of the experimental site at Manasbal Lake, Kashmir

RESULTS AND DISCUSSION

Among the fourteen species of trees (Table 1), *Populus deltoides* recorded maximum average diameter (17.54 cm), average height (21.08 m) and basal area (0.0241 m²/tree) whereas the minimum average diameter (3.04 cm), average height (6.63

m) and basal area (0.0007 m²/tree) was recorded in *Cedrus deodara*. Maximum average diameter, average height and basal area of *Populus deltoides* is attributed to its fast growing nature, attains a height of 30 m and has rotation period of just 10-12 years (Prakash, 1998). The minimum average diameter, average height and basal area of *Cedrus deodara* is due to its slow growing nature and has rotation period of 100-120 years (Luna, 2005). In a similar study, Pande *et al.* (1988) reported comparative vegetation analysis of some plantation ecosystems of *Sal*, *Teak*, *Pine* and *Eucalyptus* in which *Pinus roxburghii* was found to have maximum diameter, height and basal area. But in this study the species and the site is different and these values does not fall with in the reported range. In general the diameter, height and basal area of trees varies from site to site and the type of the plantation. The soil samples of afforested and near by barren bank of Manasbal Lake were put to analysis for the evaluation of pH, OC, available N, P, K and moisture content (Table 2). The estimated pH in case of vegetation area and barren land was 7.30 and 7.80, respectively which is indicative of neutral of slightly alkaline soil reaction. The organic carbon was high in vegetation area (2.53%) and medium in barren land (0.70%). The available nitrogen, phosphorus and potassium was high in vegetation area 295.30, 40.20 and 240.00 kg/ha respectively, whereas, in barren land it was low 167.00, 17.40 and 173.30 kg/ha respectively. The moisture content was also high in vegetation area (27.20%) compared to barren land (13.60%). Low pH in vegetation area is attributed to high organic carbon and enhanced microbial activities, which favour the decomposition of organic matter. These findings are similar to Dhar *et al.* (2001) on soils of Shankaracharya hills who reported near neutral to moderately alkaline pH. However, in barren land the pH of soil was high due to less organic carbon. Verma *et al.* (2005) and Zargar *et al.* (2005) also reported increase in pH in degraded forests. The high organic carbon in vegetation area may be due to litter fall whereas, low organic carbon in barren land could be due to absence of vegetation. Dhar *et al.* (2001)

Table 1. Growth characteristics of trees on the afforested bank of Manasbal Lake, Kashmir

S.No.	Species	Average diameter (cm)	Average height (m)	Basal area (m ² /tree)
1	<i>Acer negundo</i>	6.29	6.59	0.0031
2	<i>Aesculus indica</i>	5.03	7.13	0.0019
3	<i>Ailanthus altissima</i>	5.60	7.69	0.0024
4	<i>Albizia Julibrissin</i>	4.65	6.97	0.0016
5	<i>Catalpa bignonioides</i>	6.54	0.0044	7.54
6	<i>Celtis australis</i>	4.67	6.51	0.0017
7	<i>Cedrus deodara</i>	3.04	6.63	0.0007
8	<i>Cupressus torulosa</i>	4.86	7.14	0.0018
9	<i>Morus alba</i>	4.49	6.15	0.0015
10	<i>Populus deltoides</i>	17.54	21.08	0.0241
11	<i>Prunus armeniaca</i>	4.13	7.35	0.0013
12	<i>Robinia pseudoacacia</i>	8.65	17.83	0.0058
13	<i>Salix alba</i>	13.17	9.71	0.0136
14.	<i>Ulmus wallichiana</i>	9.78	15.90	0.0075

Table 2. Nutrient status of soil on the afforested and adjoining barren bank of Manasbal Lake, Kashmir

Vegetation/ barren land	pH	OC (%)	Available nutrient (kg/ha)			Moisture content (%)
			N	P	K	
Vegetation area	7.30	2.53	295.30	40.20	240.00	27.20
Barren land	7.80	0.70	167.00	17.40	173.30	13.60

reported high organic carbon range from 1.2 to 2.7 per cent on soil of Shankaracharya hills. Ajaz (2003) reported decrease in organic carbon in deforested area. The high soil fertility status (N, P and K) under vegetation area may be due to less biotic interferences and addition of leaf litter. These results are in conformity with Singh and Totey (1985) and Kunhikannan *et al.* (1998). The high moisture content under vegetation area may be due to high interception by trees and gradual percolation and infiltration into the ground. These observations are in line to the findings of Jha *et al.* (2001) who reported that the soil moisture was maximum under plantations and least under the barren land. Decrease in moisture content is attributed to higher temperature due to direct sunlight which in turn enhances rate of evaporation thereby reducing moisture content of soil. The same has been reported by Jha *et al.* (2001).

CONCLUSION

Based on the results it may be concluded that *Populus deltoides* recorded maximum average diameter, average height and basal area among rest of the tree species. The nutrient status of soil in terms of organic carbon available N, P and K has increased due to litter decomposition in the plantation area. Moisture content was also more in plantation area compared to barren land.

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