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Performance of Growth Attributes of Melia Composita Wild. under Different Planting Pattern

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A B S T R A C T

The present study was conducted in the stratified area of Punjab. After making a survey of stratified areas, Hanedesra and Behera sites were selected in Punjab with three distinct spacings i.e. 2mx2m, 3mx3m, and 4mx4m. After analyzing height and diameter data with statistical tool of repeated measure analysis general linear model through SPSS, it has found that the height and diameter at 3x3m spacing significantly differ from the spacing 2x2m and 4x4m spacing. While the height and diameter at 2x2m and 4x4m spacing's are found to be non-significant. The result found significant differences at 3x3m spacing, so it can be stated that the maximum increment in the height and diameter was recorded in 3x3m spacing.

Introduction

Melia composita Willd. belongs to family Meliaceae. *M. composita* bears clean cylindrical bole of usually 15-20 ft in height and sometimes goes up to 40 ft with big branches. The species originated from southern Asia (India-Pakistan-Iran). It has been introduced and widely cultivated in South Africa, Middle East, America (Bermuda, Brazil and Argentina), Australia, South East Asia-Pacific islands, and southern Europe. The tree requires deep red gravelly soil, high light intensity, rainfall of about 800-1000 mm and an elevation of 800-1000 mtrs. Seedlings can tolerate frost, however, severe frost can result in plant death. The farmers were encouraged to plant a *Melia dubia* with different agricultural crops in large scale just because of its industrial and ecological importance (Parthiban *et al.*, 2009; Nuthan *et al.*, 2009).

At present, in India, the supply of pulpwood is only to the pulp and paper industries. Bamboo and reeds were the conventional raw materials for the pulp and paper industry. Large-scale conversion of moist deciduous forests to plantations for economic gain and the construction of major hydel and irrigation projects inside the forests have led to the depletion of raw material for pulpwood. Competing demand by traditional industry has also reduced their availability to pulp and

paper industries. To meet the ever-growing demand, it was found necessary to have fast-growing species, which can yield higher pulpwood per unit area. For this purpose, *Melia composita* was found to be the best choice. Considering the above facts, following objectives were taken for the study, to study the growth potential of *Melia composita* under different planting patterns.

Materials and Methods

Keeping in view the above objectives, the current study was conducted in the stratified area of Punjab. After making a survey of stratified areas, Hanedesra and Behera sites were selected in Punjab with three distinct spacing i.e.2mx2m, 3mx3m, and 4mx4m.

For collecting data of individual trees from the field we followed different methods given by Chaturvedi and Khanna (1984). Growth parameters were taken into consideration for the collection of field data such as Height of a tree, Diameter of a tree, Current Annual Increment, Volume of a tree and Basal Area of a tree.

The height of standing measured from the tip of the leading shoot (from the highest point of the crown where there is no leader) to the ground level and was measured with the help of measuring tape. Diameter at breast -height were marked by means of measuring stick on standing trees in each plot and measured with the help of diameter tape at 1.37 m (4 ft 6inch) above the ground level. The basal area of a tree is usually defined as the cross-sectional area at breast height. It is the square of DBH and multiplied by a factor 0.00007854.Current Annual Increment (C.A.I.) is the difference between the dimensions measured at the beginning and at the end of the year's growth e.g. Volume growth.

Results and Discussion

Punjab has the best infrastructure for agro forestry and the region is ideal for agro forestry practices. Perusal of the data presented in Table 1 and 2 revealed that Girth and height in different spacing were not significant but the repeated measure analysis showed the significant change in height and Girth in spacing of 3mx3m. The average data of Girth and height of three years showed that among three spacing at site Hanedesra (PB-1), the average maximum Girth (45.61 cm) was observed in 3mx3m which was statistically at par with site Behera (PB-2) in 3mx3m spacing i.e. (46.56cm) and the average minimum girth was observed in spacing of 4mx4m i.e. (39.76 cm) at site Hanedesra (PB-1) and 41.22 cm at site Behera (PB-2) in same spacing of 4mx4m (Table 1 and 2). Similarly among different spacing, the maximum average of three years height were observed at 3mx3m spacing at Hanedesra (PB-1) i.e. 7.90m which was at par with maximum height of 8.10 m at 3mx3m at Behera site (PB-2). The minimum height of 6.99m was observed in spacing 4mx4m (6.99m) at Hanedesra (PB-1), whereas at Behera (PB-2) site, the minimum height of 7.03m was observed at spacing 4mx4m.

During 2014, among different spacing, maximum plant height (7.17m) was recorded under tree spacing of 3m×3m) at site Hanedesra (PB-1) which was statistically at par with same year and same spacing with a height of 7.42m at site Behera (PB-2), and the minimum plant height of 6.31m was recorded in spacing of 4m×4m at site Hanedesra (PB-1) and 6.38m at Behera (PB-2) in same spacing (Fig. 1 and 2). Similarly the Girth recorded among different spacings, the maximum Girth of 40.59 cm was recorded in spacing of 3m×3m at Hanedesra (PB-1) which was at par with same spacing and same year with a girth of 42.78 at site Behera (PB-2). However, the

minimum Girth of 36.10 cm in that year recorded in spacing of 4m×4m at site Hanedesra (PB-1) which was at par at same spacing in that year with an minimum Girth of 37.38cm in spacing of 4×4 at site Behera (PB-2) (Fig. 1 and 2).

In the year of 2015, Height of plants under the spacing of 3mx3m at site Hanedesra (PB-1) gave best results with attaining a height of 7.79m while the site Hanedesra (PB-1) under spacing of 4mx4m performed poor with height of 7.03 m. In case of site Behera (PB-2) maximum height of 8 m was observed at same spacing of 3mx3m and the minimum plant height of 7.02m was recorded in Spacing of 4m×4m (Fig. 1, Table 1 and 2). Similarly the Girth among different spacing, maximum Girth of 45.85cm was recorded in spacing of 3m×3m at Hanedesra (PB-1) which was at par with same spacing of 3mx3m with a girth of 46.49 cm in same year at site Behera(PB-2). However, the minimum Girth of 39.88cm in that year was recorded in spacing of 4m×4m at site Hanedesra (PB-1) which was at par at same spacing in that year with an minimum Girth of 40.94cm in spacing of 4m×4m at site Behera (PB-2) (Fig. 1, 2 and Table 1, 2).

In the study period of 2016, In terms of height among different spacing, Site Hanedesra (PB-1) under spacing of 3mx3m performed best with an attainment of maximum height of 8.73 m while it has performed poor with an attainment of height of 7.64 m under the spacing of 4mx4m. In case of Behera site (PB-2) maximum plant height i.e. 8.87m was recorded under tree spacing of (3m×3m) and the minimum height of about 7.68 m was observed under the spacing of 4mx4m (Fig. 1, 2 and Table 1, 2). Similarly the Girth among different spacing, at site Hanedesra (PB-1) maximum Girth of 50.41cm was recorded in spacing 3m×3m which was at par with same spacing of 3mx3m with a girth of50.42 cm in same year at site Behera (PB-2). However, the minimum Girth of 43.31cm in that year was recorded in spacing of 4m×4m at site Hanedesra (PB-1) which was at par with same spacing in that year with a minimum Girth of 45.33cm in spacing of 4m×4m at site Behera (PB-2) (Fig. 1, 2 and Table 1, 2).

After analyzing height and diameter data with statistical tool of repeated measure analysis general linear model through SPSS (Table 3). I have found that the height and diameter at 3x3m spacing significantly differ from the spacing 2x2m and 4x4m spacing. While the height and diameter at 2x2m and 4x4m spacing's are found to be non-significant. The result found significant differences at 3x3m spacing, so it can be stated that the maximum increment in the height and diameter was recorded in 3x3m spacing.

The study has shown that the growth in term of height and diameters showing better results in Punjab compare to Uttarakhand and Haryana. This may be due to Punjab soil might be good in soil nutrient for better growth of *Melia*. The *Melia* height differs significantly with spacing in different statutes. But the spacing of 3m×3m showing the better result in among all. The growth was shown higher in Punjab this may be due availability of soil moisture content and nutrient availability. This can be supported by the many studies. Soil moisture conservation measures and nutrient management influence plant height and collar diameter growth (Kushalappa, 1987; Nand Kishore, 1987; Rajendradu and Naidu, 1998; and Kopad and Rao, 2004; Ragvendra *et al.*, 2005).

The growth in the form of height and girths were shown higher. The main factor might be the combination of moisture and nutrient availability to increases the absorption of nutrients results in higher plant height compared to other treatments and also might

be due to the moisture balance in the plant, which regulated the leaf shedding duration by regulating moisture stress condition. Such results are evidenced from Priya and Bhat (1999), who have mentioned that these treatments have retained the green leaf for longer duration than the control mainly due to prolonged meristematic activity because of moisture availability for longer duration.

The higher plant height increment and collar diameter increment in rainy and in dry season were mainly due to higher moisture and nutrient available to the plants. The lower plant height increment and increment in control might be due to moisture stress experienced by the trees during growing period. This has been supported by Anil and Kulkarni (1995).

Maximum plant height increment and collar diameter increment in Punjab, Uttarakhand and Haryana was mainly attributed to higher absorption of moisture and nutrients supported by evidenced from Tewari (1999). Several workers have reported that collar diameter increment due to more soil moisture availability (Nonhare and Chaubey, 1996). *Melia dubia* could be one such alternate indigenous fast growing multipurpose tree species highly suitable to agroforestry systems in India with immense potential to serve the mankind by wide range of products and environmental services.

It has also been demonstrated in growth characters like tree height, diameter (Ferguson *et al.,* 1977; Naraynan *et al.,* 2009; Dlamini *et al.,* 2017), clear bole height (Jha, 2013) and bole straightness (Vargas-Reeve *et al.,* 2013). Stem girth at breast height and tree height are commonly recorded measures that gave an idea about the tree growth. Girth at breast height (GBH) recorded significantly positive correlation with the tree height similar observations were made by Tewari *et al.,* (2012) in *Prosopis juliflora* and Gupta *et al.,* (2012) in *Acacia catechu.*

An increase in diameter increment and height might be due to higher soil moisture available in Ring basin. Higher percent of available soil moisture during dry season might have helped to nutrient absorption by the plants, which in turn resulted in higher crown diameter and number of leaves (Nand Kishore, 1987; Rajendradu and Naidu, 1998). It also might have combined effect of moisture conservation methods and nutrient management would have promoted growth parameters possibly by way of active cell division and elongation thereby increasing number of branches, leaves and diameter as reported by Gupta (1990) in Eucalyptus.

Table.1 Growth performance of *Melia composita* at Hanedesra, Punjab

Year	Age of Plants (Years)	Girth(cm)	Height (m)	Girth (cm)	Height (m)	Girth(cm)	Height (m)
		Spacings (m)					
		2X2	2X2	3X3	3X3	4X4	4X4
2014	2	37.55	6.58	40.59	7.17	36.10	6.31
2015	3	41.31	7.28	45.85	7.79	39.88	7.03
2016	4	47.31	8.39	50.41	8.73	43.31	7.64
Mean		42.06	7.42	45.61	7.90	39.76	6.99
STDEv		4.92	0.91	4.91	0.78	3.60	0.66

Table.2 Growth performance of *Melia composita* at Behera, Punjab

Year	Age of Plants (years)	Girth (cm)	Height (m)	Girth (cm)	Height (m)	Girth (cm)	Height (m)
		Spacings (m)					
		2X2	2X2	3X3	3X3	4X4	4X4
2014	2	36.98	6.47	42.78	7.42	37.38	6.38
2015	3	41.69	7.28	46.49	8.00	40.94	7.02
2016	4	45.94	8.23	50.42	8.87	45.33	7.68
Mean		41.54	7.33	46.56	8.10	41.22	7.03
stdev		4.48	0.88	3.81	0.73	3.97	0.64

Table.3 Repeated measure analysis (General Linear Model) statistical analysis through SPSS

Height			
Tukey HSDA,BC,			
SPACING	N	Subset	
		1	2
2x2	108	7.122	
4x4	108	7.171	
3x3	108		7.998
Sig.		.917	1.000

Diameter			
Tukey HSD[a,b,c]			
spacing	N	Subset	
		1	2
2x2	108	40.880	
4x4	108	41.079	
3x3	108		46.090
Sig.		.938	1.000

Fig.1 Height and girth growth of Melia at Hanedesra, Punjab

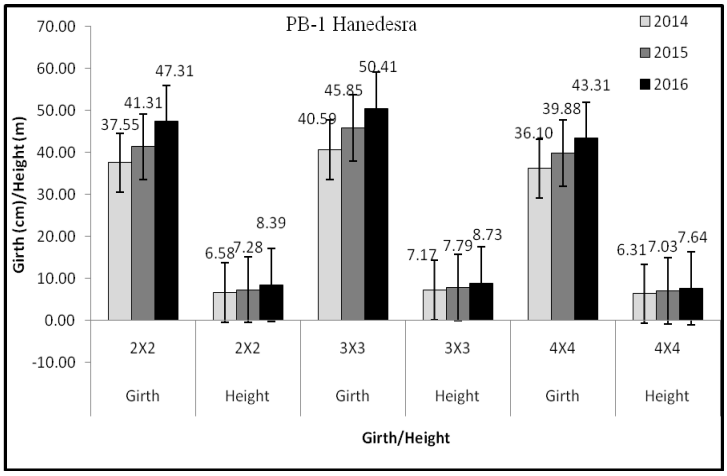
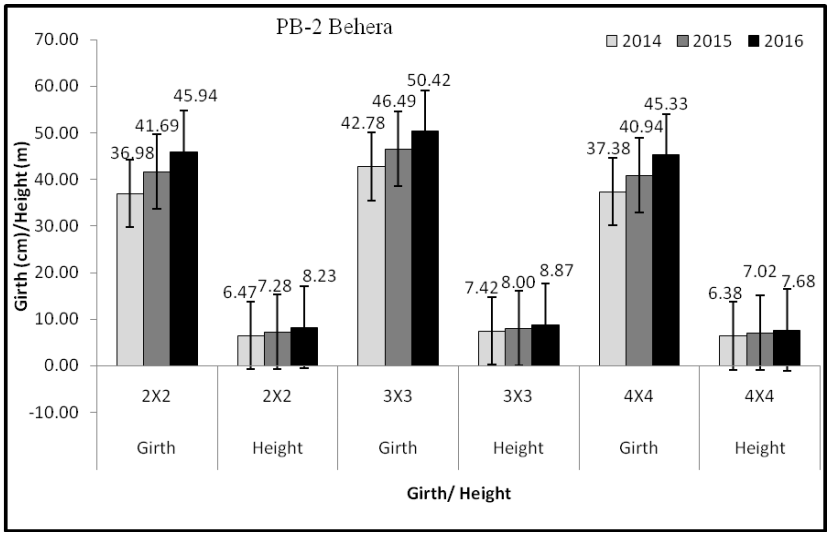


Fig.2 Height and girth growth of Melia at Behera, Punjab



After analyzing height and diameter data with statistical tool of repeated measure analysis general linear model through SPSS, it is concluded that the height and diameter at 3x3m spacing significantly differ from the spacing 2x2m and 4x4m spacing. While the height and diameter at 2x2m and 4x4m spacing's are found to be non-significant. The result found significant differences at 3x3m spacing, so it can be stated that the maximum increment in the height and diameter was recorded in 3x3m spacing.

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