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**Vishwajeet Sharma**
Forest Research Institute, Dehradun, Uttarakhand, India

**Nikita Rai**
Tropical Forest Research Institute, Jabalpur, Madhya Pradesh, India

**Pradeep Patel**
Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India

**Vedpal Singh**
Forest Research Institute, Dehradun, Uttarakhand, India

**Tara Chand**
Forest Research Institute, Dehradun, Uttarakhand, India

**Correspondence**
**Vishwajeet Sharma**
Forest Research Institute, Dehradun, Uttarakhand, India

# Effect of different planting pattern on growth of *Melia composita* Willd. in the stratified sites of Haryana

**Vishwajeet Sharma, Nikita Rai, Pradeep Patel, Vedpal Singh and Tara Chand**

**Abstract**
The study was conducted at existing plantations of stratified areas of two sites of Haryana. After making a survey of stratified areas, Hansi (HR-1) and Dupedi (HR-2) sites were selected with three distinct spacings i.e.2mx2m, 3mx3m, and 4mx4m. The growth parameters of both height and diameter were measured continuously for three consecutive years. The maximum increase in mean height was recorded at Dupedi in spacing of 3m×3m and minimum was recorded in spacing of 2m×2m. In case of girth the maximum mean girth were recorded at Dupedi in spacing of 3m×3m. Repeated measure analysis reveals that the growth attributes of height and diameter at 3mx3m were significantly differ from 2mx2m and 4mx4m spacing's. The higher growth were observed in spacing of 3m×3m which may allow the tree to have minimum branches and higher wood in stem of the *Melia sp* which may be due to the favourable micro-climate of the species created at 3mx3m spacing. The study reveals that the appropriate spacing plays a significant role in increase of amount of bole height and wood stock in minimum space and time.

**Keywords:** Height, girth, Spacings, *Melia composita* etc.

## 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) [11, 10]. *M. composita*is valued for its high-quality termite and fungus resistant timber. Its branches are used as a fuel wood, termite resistant poles and leaf as a fodder. The timber is mainly used for furniture, agricultural implements and house construction. *M. composita*has decorative appearances, which is making it suitable for furniture making. In Ceylon, it is used for the out riggers of the boats. In Java and Sumatra for the interiors of houses and it is much in demand for uprights of buildings in Tonk. The timber of *M. composita*is found to be ideal for plywood manufacture and it has been identified as one of the important species for the production of plywood at commercial scale.

At present, the plantations of fast growing, short rotation woody crop like *Melia composita* gained more importance in Carbon sequestration while providing income from wood products. *Melia* is an indigenous fast growing tree species with multipurpose uses like pulpwood, timber, fuel wood and plywood can fit as a suitable species for plantation under various agroclimatic conditions. Thus, in the recent scenario the species has greater attraction by farmers, foresters and plantation growers. The growing demand for timber can be met to some extent by utilizing alternate species and increasing the timber production through intensive silviculture management. The choice of planting density is a primary silvicultural decision which considers the trade off between individual tree size and stand production, affecting quality and quantity of products throughout the rotation. 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 Bamboo and reeds. 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. By considering the above facts following objectives have been taken up for study.

## Material and Methods

Keeping in view the above objectives, the current study was conducted in the stratified areas of Haryana. After making a survey of stratified areas, Hansi and Dupedi sites were selected in Haryana with three distinct spacings 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) [2]. Growth parameters were taken into consideration for the collection of field data such as Height of a tree and Diameter 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 ft6inch) above the ground level.

## Results and Discussion

The state of Haryana showed the good performance in agriculture which may lead to better growth for agroforestry using *Melia*. The data presented in Table 1&2 revealed that the three years data representing the Girth and height data of *Melia composita* in different spacing have not been found significant. But with analysis with statistical tool named as 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 i.e. 2014, 2015 and 2016 showed that among three spacing at site Hansi (HR-1), the average maximum Girth (45.84 cm) was observed in spacing of 3mx3m which was statistically at par with site Dupedi (HR-2) in 3mx3m spacing with a girth of 46.34cm and the average minimum girth was found to be in spacing of 2mx2m with girth of 40.75cm at site Hansi (HR-1) and 39.18cm at site Dupedi (HR-2) in same spacing of 2mx2m (Table 1 & Table 2). Similarly among different spacing the maximum average height of three years were observed at 3mx3m spacing at Hansi (HR-1) with a height of 7.98 m which was statistical at par with site Dupedi (HR-2) with a maximum height of 8.01 m in the spacing of 3mx3m. The minimum height were observed in spacing of same spacing 2mx2m with a height of 7.04 m at site Hansi (HR-1, whereas at Dupedi (HR-2) minimum height of 6.75 m was found in spacing of 2mx2m.

**Table 1:** Growth of *Melia composita* at Hansi, Haryana

| Year | Age of Plants (years) | Girth (cm) | Height (m) | Girth (cm) | Height (m) | Girth (cm) | Height (cm) |
|---|---|---|---|---|---|---|---|
| | | Spacings (m) | | | | | |
| | | 2X2 | 2X2 | 3X3 | 3X3 | 4X4 | 4X4 |
| 2014 | 2 | 36.23 | 6.30 | 41.86 | 7.24 | 37.17 | 6.33 |
| 2015 | 3 | 40.42 | 7.04 | 45.53 | 7.85 | 41.22 | 7.15 |
| 2016 | 4 | 45.62 | 7.77 | 50.12 | 8.85 | 45.83 | 8.33 |
| Mean | | 40.75 | 7.04 | 45.84 | 7.98 | 41.41 | 7.27 |
| stdev | | 4.70 | 0.74 | 4.14 | 0.81 | 4.33 | 1.01 |

During 2014, among different spacing, maximum plant height i.e. 7.24 m was recorded under tree spacing of (3m×3m) at site Hansi (HR-1) which was statistically at par with same year and same spacing with a height of 7.34 m at site Dupedi (HR-2), and the minimum plant height of 6.30 m was observed in Spacing of 2m×2m in Hansi (HR-1) while is case of Dupedi (HR-2) minimum height of 6.14 m was observed in the spacing of 2mx2m. Similarly in case of girth at different spacing, maximum Girth of 41.86cm was recorded in spacing of 3m×3m at Hansi (HR-1) which was at par with same spacing and same year with a girth of 41.51cm at site Dupedi (HR-2). However, the minimum Girth of 36.23cm in that year was recorded in spacing of2m×2m at site Hansi (HR-1) which was at par with Dupedi (HR-2) with a minimum girth of 36.28 in spacing of 2m×2m (Fig.1 & Fig.2 and Table 1 and Table 2).

**Table 2:** Growth performance of *Melia composita* at Dupedi, Haryana

| 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 | 36.28 | 6.14 | 41.51 | 7.34 | 37.92 | 6.70 |
| 2015 | 3 | 38.83 | 6.76 | 46.81 | 7.94 | 42.28 | 7.41 |
| 2016 | 4 | 42.43 | 7.34 | 50.70 | 8.76 | 46.54 | 8.22 |
| Mean | | 39.18 | 6.75 | 46.34 | 8.01 | 42.25 | 7.44 |
| stdev | | 3.08 | 0.60 | 4.61 | 0.70 | 4.30 | 0.76 |

In the year 2015, Height of plants under the spacing of 3mx3m at site Hansi (HR-1) gave best result with an attainment of height of 7.85 m while the site Hansi (HR-1) under the spacing of 2mx2m gave minimum height increment i.e 7.04 m. While in case of Dupedi (HR-2) maximum height of about 7.94 m was recorded under the spacing of 3mx3m and the minimum was observed at 2mx2m spacing with the height increment of about 6.76 m.Similarly the Girth among different spacing, maximum Girth of 45.53cm was recorded in spacing of 3m×3m at Hansi (HR-1) which was at par with Dupedi site (HR-2) with a girth increment of 46.81 cm under the same spacing of 3mx3m.However, the minimum Girth i.e. 40.42 cm in that year was recorded in spacing of 2m×2m at site Hansi (HR-1) and which was at par with the same spacing of 2mx2m in that year with the minimum Girth of 38.83cm at siteDupedi (HR-2) (Fig 1 &2 and Table 1&2).

In the year 2016, increment in the height under different spacing, maximum of 8.85 m of plant height was found to be

recorded under tree spacing of 3m×3m at site Hansi (HR-1) which was statistically at par with site Dupedi (HR-2) with a maximum increment in the height of about 8.76 m at same year and under the same spacing of 3mx3m. While the minimum plant height of 7.77 m was recorded in spacing of 2m×2m at Hansi (HR-1) which was statistically at par with a height of 7.34 m at site Dupedi (HR-2) under the spacing of 2mx2m. Similarly the girth among different spacing, 50.12 cm of maximum girth was recorded in spacing of 3m×3m at Hansi (HR-1) which was at par with the maximum girth of 50.70 cm under the same spacing of 3mx3m at site Dupedi (HR-2). However, the minimum Girth of about 45.62 cm in that year was recorded under 2m×2m spacing at site Hansi (HR-1)while in case of Dupedi (HR-2) minimum girth of about 42.43 was recorded under the same spacing of (Fig.1 &Fig.2, Table 1 & Table 2).

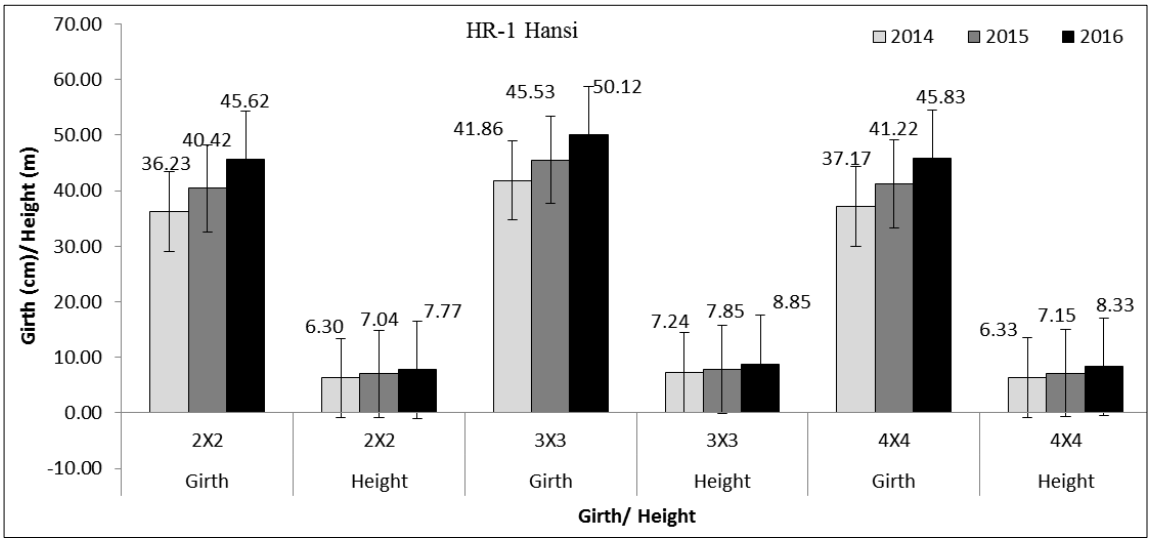


**Fig 1:** Height and Girth growth at Hansi, Haryana

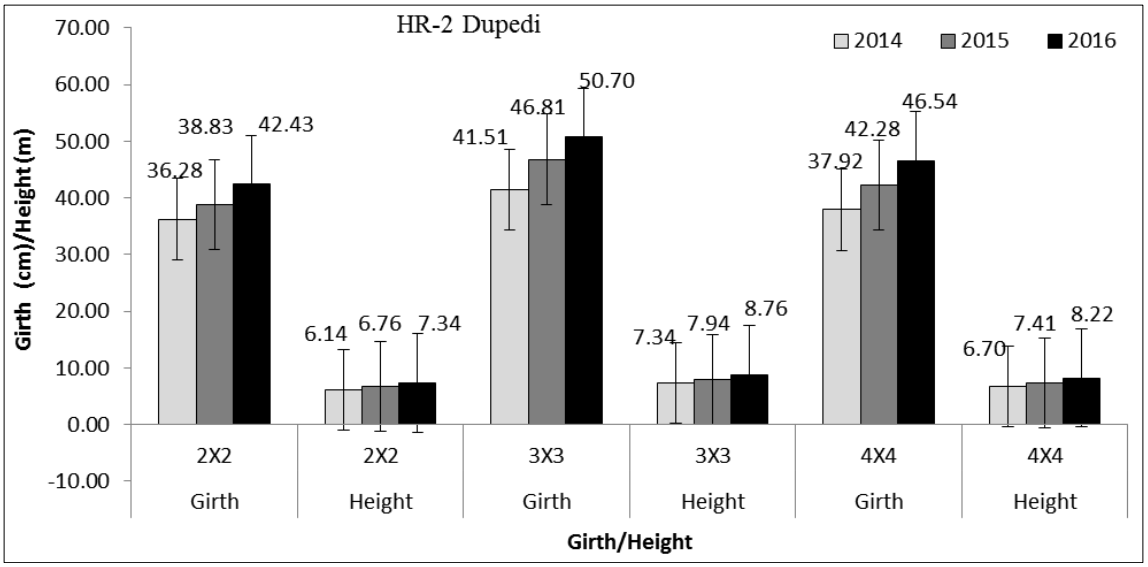


**Fig 2:** Height and Girth growth at Dupedi, Haryana

After analyzing height and diameter data with statistical tool of repeated measure analysis general linear model through SPSS. 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 at 3mx3m spacing in Haryana. This may be due to 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 3×3m showing the better result in among all. The growth was shown higher results 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; Rajendradu and Naidu, 1998; and Kopad and Rao, 2004; Ragvendra *et al*. 2005) [7, 14, 6, 13].

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) [12], 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) [1]. 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) [16]. Several workers have reported that collar diameter increment due to more soil moisture availability (Nonhare and Chaubey, 1996) [9]. *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) [4, 8], clear bole height (Jha, 2013) [5] and bole straightness. 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) [15] in *Prosopis juliflora* and 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 (Rajendradu and Naidu, 1998) [14]. 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 in Eucalyptus.

## Conclusion

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.

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