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GROWTH PERFORMANCE OF *MELIA AZEDARACH*, *MELIA COMPOSITA* AND *MELIA DUBIA* SEEDLINGS IN RESPONSE TO PRE-SOWING TREATMENT UNDER NURSERY CONDITION OF SHIVALIKS REGION OF LOWER HIMALAYAS

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ABSTRACT

A nursery experiment was carried out at the experimental farm of Division of Silviculture and Agroforestry, SKUAST- Jammu, Chatha with objective to find out the best pre-sowing nursery treatment for the growth performance of different *Melia species* viz. *Melia azedarach*, *Melia composita* and *Melia dubia.* Drupes of *Melia species* were collected and subjected (depulped) to nine different pre-sowing treatments which were as follow; (control), (cow dung slurry for 30 days), (GA_3 100 ppm for 24 hrs), ($GA_3$200 ppm for 24 hrs, ($GA_3$300 ppm for 24 hrs), ($GA_3$400 ppm for 24 hrs), ($GA_3$500 ppm for 24 hrs), (conc. H_2SO_4 for 5 min) and (conc. H_2SO_4 for 10 min). Findings of the results revealed that average seedling length (134.19 cm), collar diameter (8.29 mm), fresh shoot weight (185.91 g), dry shoot weight (52.38 g), length of primary root (14.53 cm), number of secondary and tertiary root (11.28), root: shoot ratio (0.31) and seedling quality index (5.30) was observed maximum in treatment T_2 (cow dung slurry for 30 days). However, among the different *Melia species* the growth attributes were recorded higher in *Melia composita* which was superior to *Melia azedarach* and *Melia dubia*. Results of the study suggested that pre-sowing treatment of cow dung slurry for 30 days can be used to enhance the growth performance among the different *Melia species*.

Keywords: Melia azedarach, Melia composita, Melia dubia and growth characteristics.

Introduction

The wealth of any country is recognized by its natural resources from where the countries leap the benefits for sustainable time. Among the different natural resources, forest richness is one of its kinds. The prosperity in trees biodiversity is not only helpful for mankind but also for the wood and forest-based industries. From last few decades, there was a total of 68.4 Mha humid primary forests lost globally; making 16 per cent of its total tree covers loss in the short span of time period. A huge pressure on this valuable natural resources due to the huge increase demand of wood in commercial market make this forest treasure dwindling. The rapid decrease in forest cover and low sustained yield has led to the shortage of timber and fuelwood especially in rural areas. Therefore, the area of tropical forest plantations has witnessed a phenomenal growth since the middle of twentieth century (Chauhan *et al*., 2016). Species like (Eucalyptus, Poplar and Teak) were recognized as dominant tropical plantation species (Evans and Turnbull, 2004). Owing to this, demand of *Melia composita* and *Melia dubia* plantation is rapidly increasing in recent years. *Melia*, a species of family Meliaceae has gained attention among scientific community as well as farmers and wood-based industries. *Melia species* widely grown in the tropical and sub-tropical region of India, South East Asia and Oceania (Ram *et al*., 2014) because of its fast-growing nature, stem straightness, fewer number of branches, less shade effect and being less susceptible to pest and insect attack. Though, for a successful plantation, a uniform germination of seed with good vigour is necessary for the production of quality seedling stock. However, the main constraint arises with *Melia dubia* and *Melia composita* is poor germination rate because

of indehiscent drupes. Keeping in view, this study was conducted to evaluate the performance of different pre-sowing treatments on different *Melia species* under nursery condition.

Material and Methods

Drupes were collected from the plantation of *Melia composita* species located in the farm of Division of Silviculture and Agroforestry, Chatha, Jammu, and *Melia azedarach* from road side plantation established in the main campus of the University. *Melia dubia* drupes were procured from forest nursery, Karnataka. Candidate plus tree of *Melia composita* bearing sufficient number and healthy fruits were marked for collection of fruits (drupes) in the month of January, 2021. All the drupes of different *Melia species* were dried in shade for about 30 days. Soil for the experiment was collected from division of Silviculture and Agroforestry, Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu. Soil was sieved to remove plant parts, pebbles and weeds. The soil was mixed with sand and FYM in ratio of 1:1:1. The mixture was filled in polythene bags of size 16 cm x 24 cm. The soil was sandy loam in texture. The sowing was done in the month of March, 2021. Light irrigation was applied immediately after each sowing and weeding was carried out as per requirement. The experiment was laid out in Factorial CRD (complete randomized design) having two factors, Nine pre-sowing treatments i.e. T_1 (control), T_2 (cow dung slurry for 30 days), T_3 (GA_3 100 ppm for 24 hrs), T_4 (GA_3 200 ppm for 24 hrs), T_5 (GA_3 300 ppm for 24 hrs), T_6(GA_3 400 ppm for 24 hrs), T_7 (GA_3 500 ppm for 24 hrs), T_8 (conc.H_2SO_4 for 5 min) and T_9 (conc. H_2SO_4 for 10 min) and three *Melia spp* (*Melia azedarach*, *Melia composita* and *Melia dubia*). In total there were 27 treatment combinations with three replications. There were 20 plants per replication per treatment. For recording data, four plants per treatment per replication were chosen using simple random sampling with replacement method. In this way a total of thirty-six plants per replication were chosen for data recording. After the germination, seedlings were allowed to grow to assess initial growth performance. The data for final growth parameters was recorded i.e., seedling length, collar diameter, fresh and dry shoot weight, number of secondary and tertiary roots, length of primary roots, seedling quality index and root: shoot ratio.

Results and Discussion

Different pre-sowing treatments exhibited significant influence on seedling length (Table 1). The maximum seedling length (134.2 cm) was recorded in T_2 (cow dung slurry for 30 days) which was statistically superior to all the remaining treatments whereas, the minimum seedling length (51.8cm) was observed in treatment T_1 (control). Species also showed a significant effect on seedling length, maximum seedling length (115.7 cm) was recorded in *Melia composita* which was statistically higher than *Melia azedarach* and *Melia dubia,* respectively. The interaction effect of pre-sowing treatments x species was found to be significant with respect to seedling length. The interaction T_2S_2 (cow dung slurry x *Melia composita)* resulted in maximum seedling length in *Melia composita* (152.8cm) which was statistically higher than all the remaining interactions (Table 1). The highest value observed under the treatment of cow dung slurry in *Melia composita* attributed to fact that drupes might undergone in the process of early removal, softening, damage and fermentation which cause the seed coat permeable to water for kernels which ultimately resulting in fasting the speed of emergence of radicle (Singh, 2020). The effect of pre-sowing treatments of collar diameter of the seedlings was significant. The maximum collar diameter (8.29 mm) was recorded in T_2 treatment (cow dung slurry for 30 days), which was statistically at par with treatment T_3 (GA_3 100ppm for 24 hours). The minimum collar diameter (3.95 mm) was observed in T_1 (control). The effect of species on collar diameter was found to be significant. Maximum collar diameter (8.36 mm) was observed in *Melia composita* which was significantly higher than *Melia azedarach* and *Melia dubia* respectively. The combination effect of pre-sowing treatments x species exhibited significant influence on collar diameter. Treatment combination of T_2S_2 (cow dung slurry x *Melia composita*) resulted in maximum collar diameter in *Melia composita* (10.26mm) which was found to be statistically at par with interaction T_3S_2 (GA_3 100ppm for 24 hours x *Melia composita*). Mexel *et al*., (1990) and Ashiono *et al*., (2017) reported that seedlings raised in cow dung mixture had root collar diameter range between (2.69-3.55 mm) and such seedlings have a chance of over 70 per cent of survival when transplanted in the field. Which is clearly reflected in our study where the collar diameter range was above 3.55 mm. The higher concentration of macro nutrients in cow dung provides initial elements required for the growth of collar diameter. Higher collar diameter is the result of cell division and elongation of the stem portion and vigorous growth in length of root and shoot resulted because of quicker germination (Singh, 2020). Data depicted in Table 1 reflected significant variation among pre-sowing treatment with respect to fresh and dry shoot weight. Perusal of the data revealed that maximum shoot fresh

weight (185.91 g) was found in treatment T_2 (cow slurry for 30 days) which was significantly higher than the remaining treatments. The minimum shoot weight (59.98 g) was recorded in treatment T_1(Control). The species exhibited a significant effect on fresh shoot weight (per seedling) (Table 1). The maximum shoot fresh weight (139.45 g) was recorded in *Melia composita* which was statistically superior from *Melia azedarach* and *Melia dubia*. The interaction effect of treatment and species on shoot fresh weight was also significant (Table 1). The interaction T_2S_2 (cow dung slurry for 30 days x *Melia composita*) resulted in maximum shoot fresh weight (224.24g). The influence of pre-sowing treatments on dry shoot weight was found to be significant. Perusal of the data revealed that maximum dry shoot weight (52.38 g) was recorded in treatment T_2 (cow dung slurry for 30 days) which was significantly highest to the remaining treatments. The minimum dry shoot weight (21.30 g) was observed in treatment T_1 (control). There was significant variation in dry shoot weight owing to the species (Table 1). The maximum dry shoot weight (43.56 g) was observed in *Melia composita* which was significantly higher than *Melia azedarach* and *Melia dubia* respectively. The effect of seed treatment on higher shoot and root dry weight in *Melia composita* may be due to the vigorous seedling growth and expansion in length of the root which helps in the nutrient and moisture uptake from the deeper layer of the soil. This is in close proximity with Anand *et al*., (2012) in *Melia dubia*. The effect of species on length of primary root was found to be significant (Table 2). Longest primary root (12.26cm) was recorded in *Melia composita* which was statistically at par with *Melia azedarach* (11.63 cm). The interaction of pre-sowing treatment x species also significantly influenced the length of primary root. The interaction T_2S_2 (cow dung slurry for 30 days x *Melia composita*) resulted in longest primary root length (16.24 cm) which was statistically at par with T_2S_1 (*Melia azedarach* x cow dung slurry for 30 days). The shortest primary root length (4.18 cm) was recorded in T_1S_3 (control x *Melia dubia*) (Table 2). There was significant variation in number of secondary and tertiary roots owing to the treatments (Table 2). The maximum (11.28) number of secondary and tertiary roots was observed in treatment T_2 (cow dung slurry for 30 days) which was statistically at par with treatment T_3 (GA_3 100ppm for 24 hours). The minimum (5.43) number of secondary roots was observed in treatment T_1 (control). The effect of species on number of secondary and tertiary roots was significant (Table 2). The number of secondary and tertiary roots was significantly higher (10.97) in *Melia composita* as compare to other two species. The interaction effect of pre-sowing treatments and species exhibited significant influence on number of secondary and tertiary roots. The number of secondary and tertiary root was significantly highest (13.55) in interaction T_2S_2 (cow dung slurry for 30 days x *Melia composita*) which was statistically at par with treatment T_3 (GA_3 100ppm for 24 hours x *Melia composita*). Increase in length of primary root, secondary and tertiary in *Melia composita* under the treatment cow dung slurry might be due to a series of enzymatic breakdown of seeds treated with cow dung slurry resulted into the embryo transformation and increase the primary, secondary and tertiary root length. This result is in also confirmation with Pamei *et al.,* 2017 in Teak and Suteesh *et al*., 2016 in *Santalum album* Pre-sowing treatments significantly influenced root: shoot ratio (Table 2). The maximum root: shoot ratio (0.31) was recorded in treatment T_2 (cow dung slurry for 30 days) which was statistically at par with treatment T_3 (GA_3 100 ppm for 24 hours). The minimum root: shoot ratio (0.11) was observed in treatment T_1 (control) (Table 2). The maximum root: shoot ratio (0.26) was found in *Melia composita* which was significantly superior to *Melia azedarach* and *Melia composita* respectively. In the present investigation the root: shoot ratio of *Melia composita* was significantly influenced by cow dung slurry treatment. This might be due to higher growth in root length then shoot length (Singh2020). The impact of pre-sowing treatments on seedling quality index was significant (Table 2). The seedling quality index (5.30) was highest in treatment T_2 (cow dung slurry for 30 days) which was statistically at par with treatment T_3 (GA_3 100 ppm for 24 hours). The minimum seedling quality index (2.64) was observed in treatment T_1 (control). Species had a significant effect on seedling quality index. The highest seedling quality index (4.81) was observed in *Melia composita* which was significantly higher than *Melia azedarach* and *Melia dubia* respectively. The interaction of pre-sowing treatments and species exhibited significant effect on seedling quality index. Interaction T_3S_2 (GA_3 100ppm x *Melia composita*) resulted in maximum (5.86) seedling quality index. Higher the value of seedling quality index indicates higher will be the value of seedling quality of seedlings (Oliovo and Budubua, 2016). The Dickson quality index (Dickson, *et al*., 1960) consider the altogether all the qualities of seedlings which was well observed in our present study. The maximum growth parameters were recorded in cow dung slurry for 30 days in *Melia composita* might be due to early germination of drupes. Also, the presence of low carbon-nitrogen ratio of

25:30, micro nutrient and high-water holding capacity in cow dung manure enhanced the growth.

Conclusion

The findings of this study clearly indicated that pre-sowing treatment cow dung slurry for 30 days resulted in maximum growth parameters in *Melia composita* which was significantly higher from *Melia azedarach* and *Melia dubia*. Hence, it can be concluded that drupes of *Melia composita* could be treated with cow dung slurry to enhance the growth performance and production of quality seedling stock.

Table 1 : Effect of pre-sowing treatments on seedling length, collar diameter, fresh shoot weight and dry shoot weight of different *Melia species*

Species	Seedling length (cm), collar diameter (mm)									
	Treatments									
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	Mean
M. azeadarch	52.15 (3.90)	132.96 (8.05)	123.14 (7.90)	111.11 (7.01)	110.85 (6.93)	100.44 (6.21)	95.88 (6.86)	91.44 (5.47)	88.2 (6.67)	100.69 (6.56)
M. composita	61.73 (4.16)	152.82 (1026)	147.02 (9.97)	134.93 (9.51)	124.49 (9.03)	115.73 (8.57)	102.78 (9.11)	100.28 (7.31)	101.32 (7.28)	115.68 (8.36)
M.dubia	41.6 (3.79)	116.80 (6056)	100.37 (6.51)	91.57 (6.66)	89.62 (5.91)	90.99 (5.64)	86.43 (4.88)	82.11 (4.35)	80.86 (5.89)	86.71 (5.58)
Mean	51.83 (3.95)	134.19 (8029)	123.51 (8.13)	112.54 (7.73)	108.32 (7.29)	102.38 (6.81)	95.03 (6.95)	91.28 (5.71)	90.13 (6.61)	
$CD_{(0.05)}$	Treatment= 2.27(0.33)			Species = 1.32(0.18)			Treatment x species =3.95(0.56)			
	Fresh shoot weight (g),dry shoot weight (g)									
M. azeadarch	63.44 (20.82)	182.27 (54.17)	174.49 (47.18)	141.33 (44.56)	125.27 (43.36)	110.24 (44.76)	100.27 (40.90)	91.85 (39.80)	92.99 (38.36)	120.46 (41.54)
M. composita	70.39 (28.25)	224.24 (57.01)	206.42 (48.12)	176.47 (45.13)	151.14 (46.17)	132.47 (45.73)	100.19 (41.71)	100.08 (40.36)	93.68(39.55)	139.45 (43.56)
M.dubia	46.12 (14.83)	151.22 (45.96)	131.19 (38.00)	129.35 (40.42)	98.67 (37.18)	112.47 (39.80)	85.14 (33.47)	86.55(30.88)	92.09 (30.52)	103.65 (34.56)
Mean	59.98 (21.30)	185.91 (52.38)	170.70 (44.45)	149.05 (43.37)	125.02 (42.33)	118.39 (43.43)	95.87 (38.70)	92.83 (37.01)	92.92 (36.14)	
$CD_{(0.05)}$	Treatment= 4.43(1.90)			Species = 2.56(1.10)			Treatment x species = 7.66(NS)			

Table 2 : Effect of pre-sowing treatments on length of primary root, number of secondary and tertiary roots, root: shoot ratio and seedling quality index

Species	Length of primary root (cm) (Number of secondary and tertiary root)									
	Treatments									
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	Mean
M. azeadarch	5.32 (5.23)	15.21 (10.15)	13.48 (10.19)	14.13 (10.66)	12.35 (9.95)	11.02 (10.51)	11.26 (9.31)	10.21 (9.42)	11.70 (10.45)	11.63 (9.54)
M. composita	6.55 (6.11)	16.24 (13.55)	14.11 (13.35)	13.20 (10.58)	13.05 (11.44)	12.41 (10.98)	13.70 (10.03)	10.89 (10.72)	10.20 (11.96)	12.26 (10.97)
M.dubia	4.18 (4.95)	12.14 (10.13)	11.08 (9.96)	11.30 (10.76)	11.41 (9.51)	12.69 (8.87)	10.33 (8.25)	9.80 (8.94)	10.13 (7.61)	10.34 (8.78)
Mean	5.35 (5.43)	14.53 (11.28)	12.89 (11.16)	12.88 (10.67)	12.27 (10.30)	12.04 (10.12)	11.76 (9.20)	10.30 (9.69)	10.68 (10.01)	
$CD_{(0.05)}$	Treatment= 0.61 (0.50)			Species = 0.35 (0.29)			Treatment x species =1.05 (0.86)			
	Root: shoot ratio (seedling quality index)									
M. azeadarch	0.17 (2.70)	0.32 (5.14)	0.29 (5.12)	0.27 (4.78)	0.24 (4.74)	0.21 (4.47)	0.20 (4.39)	0.24 (3.44)	0.25 (4.4)	0.24 (4.36)
M. composita	0.16 (2.91)	0.33 (5.75)	0.29 (5.86)	0.28 (5.49)	0.25 (5.40)	0.23 (5.18)	0.24 (4.81)	0.28 (3.96)	0.28 (3.94)	0.26 (4.81)
M.dubia	0.19 (2.33)	0.29 (5.01)	0.28 (4.70)	0.25 (5.09)	0.21 (4.45)	0.20 (4.15)	0.21 (3.43)	0.27 (3.04)	0.24 (3.94)	0.23 (4.02)
Mean	0.17 (2.64)	0.31 (5.30)	0.29 (5.23)	0.27 (5.12)	0.23 (4.86)	0.21 (4.60)	0.21 (4.21)	0.22 (3.48)	0.26 (4.12)	
$CD_{(0.05)}$	Treatment= 0.03(0.16)			Species = 0.01(0.11)			Treatment x species = NS(0.32)			

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