Indian Journal of Agricultural Sciences **83** (12): 1416–19, December 2013/Short Communication

Pre-sowing seed treatments in *Melia dubia*

A KRISHNA[1], VINOD KUMAR[2] and J J LEBBA[3]

College of Forestry, University of Agricultural Sciences, Dharwad, Karnataka 581 401

Received: 21 June 2012; Revised accepted: 2 May 2013

Key words: Dormancy, Germination, *Melia dubia,* Seed moisture, Vigour index

Melia dubia Cav., well known as Malabar neem tree, belongs to the family *Meliaceae*, is native to India but is now grown in all the warmer parts of the world. It is a fast growing, multipurpose indigenous tree species which is an excellent tree fodder in the high rainfall areas of the state and a very good fodder source for the livestock especially in the lean period (summer) for goats and sheep. It is also a good raw material for wood based industries like paper and plywood, an important medicinal tree and a good source of biopesticide. In India, it is naturally distributed in forest of Sikkim Himalayas, north Bengal and upper Asom, khasi hills of Odisha, north Circaras Deccan and Western Ghats at altitudes of 1500 - 1800 m. It grows rapidly and is adapted to diverse soil and climatic conditions. It has the potential of yielding in excess of 40 tonnes of biomass per acre per annum. The tree is a light demander and the seedlings are suppressed under shade. Its rotation was reported to be four to six years and have high productivity compared to common plantation species. It has a high potential to become one of the most important tree fodder and plantation species in the future (Parthiban *et al.* 2009).

Of late, *Melia dubia* species is gaining more popularity in southern states of India for its fast growth and wide adaptability in diverse edaphic and climatic conditions. A uniform germination of seed with good vigour is necessary for the production of uniform planting stock which is a prerequisite for any successful domestication. Eventhough vegetative propagation has a solution for this problem, seed propagation remains the principal mode of propagation of agro-forestry trees. As they are produced in large numbers and are readily available each year or at a definite interval and can be stored for future use (Fenner and Thompson 2005).

The demand for nursery grown seedlings of this species has increased immensely among farmers. So there is need to produce large stock of healthy and vigorous seedlings in short duration, by appropriate pre-sowing treatments. However, due to poor germination the species is difficult to multiply. It also shows a poor recruitment in the wild. Hence, the detailed study of seed biology helps to understand the secrets of germination problems in natural condition and to develop the mode of rectification in controlled nursery conditions. Keeping this in view, the present investigation was carried out with objective of understanding the seed biology and influence of pre-sowing treatments on seed germination in *Melia dubia*.

The experiment was conducted in the nursery of college of forestry, University of Agricultural Sciences, Sirsi during 2009-10. The seeds were collected manually from ten matured, healthy mother trees from semi-evergreen forest of Idugundhi forest range, Yellapur division, near Kaiga in Central Western Ghats during December-January. After collection, various qualitative and quantitative characters of the fruits were recorded. The collected fruits were brought to the laboratory in gunny bags, processed to get clean and pure seeds of high physiological quality. The pulp of the fruit was extracted by fermentation and heating as it is difficult to remove manually. Finally the seed was allowed to air dry. After seed processing was completed the fruits were dried under shade in a well-ventilated place to study the effect of moisture content on seed germination. For each treatment, 300 seeds were taken at random in every alternate day's up to 14 days of drying. The sample was then divided into two lots, one lot was used for moisture analysis and second lot was sown in three replications in the nursery bed for germination studies. Aftercare like watering and weeding was done regularly in the beds as and when required throughout the experimental period.

In second experiment, seeds were given the following pre-sowing treatments: control, i e without any treatment. (T_1); soaked in ratio of 1:2 proportions of cold water for 24 hours (T_2); mechanical scarification; fruits were cut longitudinally without damaging seeds (T_3); fruits dipped in

[1]Associate Professor (e mail: krishna.comar@gmail.com), [2]Senior Scientist (e mail: vinoddhone@yahoo.com), Indian Grassland and Fodder Research Institute, SRRS, Dharwad, [3]Research Associate (e mail: lebbajj@gmail.com)

concentrated H_2SO_4 for 5 min (T_4); seeds soaked in 100 ppm gibberllic acid in 1:2 proportions to chemical solution for 8 hours (T_5); combination of T_3 and T_5 (T_6); 1% H_2O_2 for 24 hr (T_7); KNO_3 200 milli moles/litre for 24 hr at 25°C and immediately kept in dark. (T_8); cow dung slurry for 5 days (T_9); boiling water for 10 minute (T_{10}); mini sachet method (T_{11}). In mini sachet method, seeds were sown in open bed by providing airtight polythene covering after giving a mulch of dried grass to retain moisture. Then seeds were exposed to direct sunlight in same condition for five days. All the treatments were timed in such a way that all of them would end at the same time.

Three hundred randomly collected fresh seeds of *Melia dubia* were used for each treatment which is replicated thrice. Seeds of each treatment were sown in pre prepared nursery beds. The number of seeds germinated in each day was counted; emergence of plumule was taken as the criterion of germination. The germination was recorded up to 60 days from the day of sowing. The seed quality parameters were recorded at the end of the germination test period as per ISTA procedure.

Fruit and seed biology parameters of *Melia dubia* (Table 1) indicated that its fruit length varied from 15.5 mm to 35.0 mm with average of 22.52 mm. The fruit thickness ranged from 10.2 mm to 20.5 mm and the average was 13.42 mm. There existed wide variation in fruit thickness compared to length. Fruits were drupe with hard seed coat and ovate in shape. Fruit shape ranged from roundish to elongated ones and some were wrinkled. Fruit weight ranged from 1.5 g to 2.5 g and the average weight was 1.85 g. The fruit volume estimated using water displacement method was 1.50 cm^3 and the average fruit density recorded was 1.23 g/cm^3. The fruit with 4 to 5 seeded drupe having a soft yellowish pulp turned light brown in colour after processing. The fruit moisture content was analyzed by oven dry method and was found 20 per cent when it is estimated from fresh fruits. The results of tetrazolium test shows that the viability percentage of seeds was 92 per cent. The cutting test done in seeds showed, 10 per cent empty locules. Similar results were noticed in investigations made by Chitra Devi *et al.* (2007) in *Thespesia lampa*.

Table 1 Fruit and seed biology parameters in *Melia dubia*

Seed and fruit parameter	Range	Mean
Mean fruit length (mm)	15.5 to 35.0	22.52
Mean fruit thickness (mm)	10.2 to 20.5	13.42
Mean fruit weight (g)	1.5 to 2.5	1.85
Mean fruit volume (cm^3)	1.13 to 1.68	1.50
Mean fruit density (g/cm^3)	0.93 to 1.46	1.23
Mean fruit moisture content	15.69 to 24.58	20.0
Seed viability (Percentage)	86.5 to 95.5	92.0
Fruit emptiness (Percentage)	8.45 to 13.80	10.0
Test weight (g)	158 to 196.33	185.52
Fruit shape	Ovate	
Fruit colour	Light brown	
Fruiting period	January	
Fruit maturation	Eleven months	
Germination pattern of normal whole fruit	a) Single seedling b) Double seedling c) Triplet seedling d) Quadruple seedling	
Germination pattern of mechanically extracted individual seed from drupe	Single seedling with peculiar type of growth pattern	
Germination type	Epigeal	

The test weight (100 seed weight) was 185.52 g. On an average one kilogram of *Melia dubia* fruits contain about 540 drupes. The fruit takes long period to mature in natural condition. In the present study, it took 11 months to complete the development stages of maturation. The germination pattern showed a distinct variation when whole fruit and mechanically extracted seeds were sown. The whole fruit generally produced single seedling but rarely did it produce twin, triplet and quadruple seedlings from single fruit. Similar results were reported by Chauhan and Shams (2008) in *Delonix regia*.

The fruit moisture content had no influence on the seed germination per cent among different treatments (Table 2). The variation in seed germination percentage was negligible between treatments due to sharp reduction in fruit moisture after harvesting. However, the fruit moisture content of fresh seed was 21.2 per cent with a germination of 10.50 per cent. This was reduced to 17.20 per cent followed by 15.5 per cent, 14.32 per cent, 13.68 per cent, 12.01 per cent, 11.25 per cent and 10.0 per cent in subsequent drying of 2, 4, 6, 8, 10, 12 and 14 days of shade drying, respectively. However, not much variation was observed in the seed germination even after reduction in moisture content from 21.2 per cent to 10.0

Table 2 Effect of fruit moisture content on seed germination in *Melia dubia*

Treatment	Moisture (%)	Germination (%)
T_1: Immediately after collection (Fresh seed)	21.20	10.50
T_2: Two days of drying under shade	17.20	10.25
T_3: Four days of drying under shade	15.50	9.20
T_4: Six days drying of under shade	14.34	9.50
T_5: Eight days of drying under shade	13.68	10.72
T_6: Ten days of drying under shade	12.01	8.76
T_7: Twelve days of drying under shade	11.25	9.28
T_8: Fourteen days of drying under shade	10.00	9.53
SEm±	1.87	1.23
CD (P=0.05)	5.26	NS

Table 3 Effect of various pre-sowing treatments on seed germination and quality parameters in *Melia dubia*

Treatment	Germination (%)	Mean daily germination	Peak value	Seedling height (cm)	Vigour index
T_1 Control	10.67	0.17	0.24	15.50	165
T_2 Cold water soaking (24 h)	11.33	0.20	0.26	17.07	194
T_3 Mechanical scarification	8.00	0.13	0.17	18.10	145
T_4 Concentrated H_2SO_4 (5 m dipping)	6.00	0.10	0.01	14.07	84
T_5 GA_3 100 ppm (8 h)	25.33	0.51	0.58	18.31	464
T_6 Mechanical + GA_3 100 ppm (8 h)	28.67	0.60	0.68	19.27	553
T_7 H_2O_2 (1% for 24 h)	6.67	0.11	0.14	13.77	91
T_8 KNO_3 200 milli Moles/litre (24 h, 25°c in dark)	7.33	0.12	0.16	12.80	94
T_9 Cow dung slurry (5 days)	44.67	0.95	1.12	26.10	1167
T_{10} Boiling water (10 m)	13.33	0.23	0.29	19.03	254
T_{11} Mini sachet method (5 days)	33.33	0.64	0.81	22.80	761
SEm±	1.63	0.03	0.04	0.40	36.06
CD (P=0.05)	4.79	0.09	0.11	1.19	105.77

per cent thereby indicating the sub orthodox nature of *Melia dubia* seeds, unlike other members of *Meliaceae* which are mostly recalcitrant in nature. Vargheese and Naithani (2000) also reported that there is no significant difference in germination percent while reducing the moisture content up to 6.06 % in *Azadirachta indica*.

Seed germination was significantly higher (44.67 %) in T_9 which was followed by T_{11} (33.33 %), T_6 (28.67%) and T_5 (25.33 %) (Table 3). The germination percentage was poor in concentrated H_2SO_4 (5 min dipping) (6.00%). Similar results were also reported by Naidu and Mastan (2001) in *Pterocarpus marsupium*. The maximum mean daily germination (0.95) was observed in cow dung treatment for 5 days which was followed by mini sachet method (0.64), mechanical scarification + gibberllic acid @ 100 ppm for 8 hours (0.60) and gibberllic acid @ 100 ppm for 8 hours (0.51). There was an increase of 82.1 % in mean daily germination due to cow dung treatment for 5 days when compared to control. The pre-sowing treatments initiated the early germination process and reduced the period of germination by facilitating enhanced imbibitions of water into cotyledons and hastened the biochemical reactions thereby increased the mean daily germination and peak value. Thus the liberation of enzyme rapidly increases the whole system that is already in motion, so that when the seeds are sown, developmental processes go on rapidly leading to higher germination with reduced germination period.

The treatment of soaking the seed in cow dung treatment for 5 days expressed significantly highest peak value (1.12) followed by 0.81 in mini sachet method. The lowest mean daily germination (0.01) was recorded in concentrated H_2SO_4 for 5 min dipping and is followed by 0.14 in H_2O_2 1% for 24 h, 0.16 in KNO_3 200 milli moles/litre for 24 h at 25°C in dark, 0.17 in mechanical scarification and 0.24 in control. Peak value of germination increased (79.29%) due to cow dung treatment for 5 days over control during the experimentation. Storage reserves for seed germination might have been utilized especially in *Melia dubia* to enhance the germination, so that developmental processes occur more rapidly after sowing in pre treated seeds than treated seeds. Rai (1999) reported similar finding in *Terminalia tomentosa* and *Pterocarpus santalinus.*

Maximum seedling height at the end of germination period was found to be 26.1 cm in cow dung treatment for 5 days, which was followed by 22.8 cm in mini sachet method. The minimum seedling height of 12.8 cm was recorded in KNO_3 200 milli moles/litre for 24 hr at 25°C in dark. Significantly higher seedling vigour index of 1167 was recorded in cow dung treatment for 5 days followed by 761 in mini sachet method. Significantly lower seedling vigour index values were recorded in T_4 (84) followed by H_2O_2 1% for 24 hr (91). These results were in agreement with the study conducted by Vargheese and Naithani (2000).

SUMMARY

Among the different pre treated seeds, the maximum germination percentage was found to be 44.67% in cow dung treatment for 5 days (T_9) which was followed by T_{11}: mini sachet method (33.33%). The increase in germination percentage in treatment T_9 was 34 per cent compared to control. Likewise, the speed of germination and seed quality parameters were also maximum in cow dung treatment (T_9) over control. In general, all the pre sowing treatments significantly improved the seed germination and its quality parameters over control in *Melia dubia* seeds.

REFERENCES

Chauhan Y S and Shams P M. 2008. Seed germination and morphological traits of seed/pod of *Delonix regia. Annals of Forestry* **16** (2): 255–60.

Chitra Devi, Pandey L S, Kak Anjali and Gupta Veena. 2007. Dormancy and seed germination in *Thespesia lampa* Dalz. and Cibs: A potential agro-forestry and medicinal species. *Indian Forester* **133**(9): 1 683–9.

Fenner M and Thompson K. 2005. *The Ecology of Seeds*, pp 97–104; 110–131. Cambridge University Press.

Naidu C V and Mastan M. 2001. Seed pre treatment methods to improve germination in *Pterocarpus santalinus. Indian Journal of Forestry* **24**(3): 342–3.

Parthiban K T, Bharathi A K, Seenivasan R. Kamala K and Rao M G. 2009. Integrating *Melia dubia* in agroforestry farms as alternate pulpwood species in Asia-Pacific. *Agro forestry Newsletter* **34**: 15–9.

Rai S N. 1999. *Nursery and Planting Techniques of Forest Trees in Tropical South Asia,* pp. 102. Panarvasu Publications, Dharwad.

Vargheese B and Naithani S C. 2000. Desiccation induced loss of vigour and viability during storage in neem (*Azadirachta indica* A. Juss) seeds. *Seed Science and Technology* **26** (1): 485–96.