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Studies on Effect of Pre-Sowing Seed Treatments on Seed Germination and Seedlings Vigour of *Buchanania lanzana* Spreng

K.P. Vijayalakshmi, Ramakrishna Hegde, B. Shashank and Sudeesh

Department of Silviculture and Agroforestry, College of Forestry, Ponnampet-571 216, India
Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga-577 201, India
E-mail: ramakrishnahegde@uahs.edu.in

Abstract: *Buchanania lanzana (Chironji)* has high socioeconomic value providing livelihood to tribal population of the area and has high potential as commercial agroforestry species. At present, the plant is grouped as an underexploited and non-nationalized minor forest produce. It is free for collection, because of which the local inhabitants, traders, and merchants destroy the branches/whole trees during the collection of its fruits without bothering about its regeneration. This has led to the destruction of chironji plants in the forests. Hence, there is an urgent need to develop a technology for easy multiplication and regeneration of chironji, and to popularize its importance among local inhabitants/tribals. Germination is one of the main problems in plant propagation by seed. The very hard seed coat of chironji makes it impermeable to imbibition and gas exchange resulting in low germination and vigor. The present study was carried out to assess the possibility to get the maximum percent of germination in *Buchanania lanzan* seeds which were treated with different pre-sowing treatments. Among the different pre-sowing treatments cow dung slurry for 48 hours showed the highest germination percentage (84.5%), peak germination value (3.97), mean daily germination (3.01), speed of germination (11.9) and total seedling height (17.65 cm).

Keywords: Chironji, Socioeconomic, Destruction, Regeneration, Pre-sowing, Germination percentage

Chironji (*Buchanania lanzan* Spreng.), often called charonji, is a member of the Anacardiaceae family, originated in the Indian sub-continent, and is an excellent tree for agroforestry. It assumes great significance due to its multifarious uses and capacity to withstand adverse climatic conditions. The tree grows naturally in India's tropical deciduous woods, primarily in the states of Madhya Pradesh, Bihar, Orissa, Andhra Pradesh, Chhattisgarh, Jharkhand, Gujarat, Rajasthan, and Maharashtra (Kumar et al 2012, Avani 2015). It is an Indian Western Ghats medicinal tree that is on the verge of extinction due to habitat loss, prolonged dormancy and tree uprooting for its medicinal value (Ajith et al 2018). In accordance with the country's many agro-climatic zones, Chironji plants blossom from January to March. Fruits ripen from April to June, and the bulk of seed collection occurs during this period (April). Early harvesting has a detrimental effect on the germination and quality of their seeds. Both seeds and vegetative methods (softwood grafting, chip budding, and root cutting) are used to grow chironji (Thounaojam et al 2020). Currently, it is growing under forest conditions as an underexploited and non-nationalized minor forest produce and gives monetary benefit to tribal communities in Chattisgarh (Rajput et al 2018). The kernel is highly nutritious and rich in protein (25-30%) and yields sweet oil, which can be used to substitute olive and almond oil (Avani et al 2015). Trees have an alternate bearing nature as present in the mango (Rajput et al 2018). Kernels are of very high value and fetch Rs. 800-1000 per kg in the market (Gohil et al 2016). This versatile tree serves the community's needs for food, fire, fodder, timber, and medicine (Dwivedi et al 2012). It is a common and delectable nut fruit that can be consumed either raw or roasted and is also used to make desserts (Avani et al 2015). Locals use its leaf as green fodder for their animals, particularly buffalo, goats, and sheep, during the summer when green fodder is scarce. Wood is dried and used as fuelwood. Because it is free to collect, locals, traders, and merchants cut down whole branches and trees to get the fruit, disregarding the need for fresh plants. As a result, Chironji plants in the woodlands have been decimated (Dwivedi et al 2012). As the species is used in commercial horticulture, this species has significant socioeconomic importance. Unfortunately, over exploitation and careless harvesting (lopping and chopping) pose a serious threat to it, necessitating urgent conservation measures at all levels. More land being covered by new plantations is the strategy to increase and preserve the Chironji plantation. Keeping in mind these facts and to satisfy the local need for chironji planting material of high grade is required (Rajput et al 2018). The main issue with the seed is the hard seed coat, which results in low germination and the availability of seeds only for a short time (April). There is also a problem with

germination because the seeds are more susceptible to fungal and microbial invasion (Usha 1996). Given the significance of *Buchanania lanzan* and the difficulties associated with seed propagation, understanding the elements that contribute to poor germination in seeds as well as how to overcome these obstacles would be helpful for large-scale multiplication. In light of this context, the study was initiated with the following goals: to examine pre-sowing seed treatment for improving germination, and determine the optimal treatment for producing high-quality seedlings.

MATERIAL AND METHODS

The present study was carried out at College of Forestry, Ponnampet, Karnataka, India, located in the central part of Western Ghats. *Buchanania lanzan* fruits were collected from middle aged trees and seeds were de-pulped by soaking in normal water. Collected seeds were thoroughly hand mixed to ensure the homogeneity of each lot before grading. *Buchania lanzan* seed germination experiments were conducted in a Completely Randomized Design with different treatments namely T1-Water soaking for 72 hours; T2- Alternate wetting (12 h) and drying (12 h) two cycle for 48 h; T3- Alternate wetting (12 h) and drying (12 h) three cycle for 72 h; T4- AWD 48 hours + $GA_3$500 ppm for 12 h; T5- Soaking seeds in lime solution for 24 h; T6-Lime+jagger solution for 24 hours; T7- Cowdung slurry for 48 hours; T8- Soaking in cow urine for 48 hours; T9-Control.

In each treatment, four replications with 400 seeds were used per replication and total 3600 seeds were sown in different root trainers having potting mixture prepared by adding Soil: Sand: Vermicompost in 2:1:1 ratio. Filled root trainers were placed in a nursery bed. The root trainers were watered regularly on daily basis. Following observations were recorded. The nursery bed was observed daily, for seedling emergence. The day on which the first seedling emerged was expressed as days to initial germination. The number of days on which the last seedling emerged was recorded and expressed as days to final germination. Speed of germination was calculated by the following formula- Speed of germination= n1/d1+n2/d2+n3/d3+----------, Where, n = number of germinated seeds; d= number of days. Germination per cent was calculated as number of normal seedlings/total number of seed sown x 100. Peak value of germination (PV), which denotes the speed of germination, which is the maximum mean daily germination, recorded at any time during the period of test. Germination value (GV) was calculated using the following formula GV = MDG x PV (Czabator1962). Seedling growth parameters like collar diameter, shoot length, root length, and total seedling length were measured as per standard procedures. To record seedling dry weight all normal seedlings were dried under shade for 24 hours and then dried in hot air oven maintained at 70± 1°C for 72 hours. It was cooled in a desiccator for 30 minutes and weighed in grams. Dry weight of individual seedlings was computed and expressed as g per seedling. Seedlimg index was calculated using formula- Vigour index = Germination percentage x Total dry weight (Abdul-Baki and Anderson, 1973). Similarly, quality of produced seedling was determined by using Seedling Quality Index

$$\text{Quality index} = \frac{\text{Total dry weight of seedlings (g)}}{\frac{\text{Height of seedling (cm)}}{\text{Diameter of seedlings (mm)}} + \frac{\text{Shoot dry weight (g)}}{\text{Root dry weight (g)}}}$$

RESULTS AND DISCUSSION

The initial germination ranged from 9 (T1 and T7) - 13 days (T9) and days taken to final germination ranged between 27-28 days in all the treatments except T5 (Table 1). Peak value of seed germination varied from 1.14 (T9) to 3.95 (T7). Values of seed germination varied from 26.50 % (T9) to 84.50 % (T7). Values of speed of germination varied from 3.21 (T9) to 10.16 (T1).

Thus, seed germination and different associated parameters varied for different pre-sowing treatments. Among the different pre-sowing seed treatments, treating seeds with cow dung slurry for 48 hours was found to be better. The similar trend was observed in *Melia dubia* and sandalwood seeds soaked in cowdung slurry for seven days showed increased germination speed, germination percentage, seedling growth and biomass production compared to the control treatments (Anand et al 2012, Sutheesh et al 2016).

The highest germination percentage among the treatments is observed in treatment T7 *i.e.* seeds treated with cowdung slurry for 48 hours (84.5%), followed by treatment T1 i.e. seeds soaked in water for 72 hours (78.5%) and least was observed in T9 (26.5%). Similar trend of maximum germination (66.11%) of *Manilkara hexandra L.* were recorded in treatment, 12 hrs soaking in cattle urine+ 12 hrs keeping in cow dung slurry followed by 24 hrs soaking in cattle urine (20%). The higher germination percentage in cattle urine and cowdung slurry treatment may be attributed to the presence of growth promoting substances (auxins) in cattle cowdung (Shinde et al 2015). Collar diameter recorded significant difference between the treatments. Seeds treated with lime solution for 24 hours showed highest value of collar diameter of 2.16 mm, followed by seeds treated with AWD (Alternative Wetting and Drying) for 72 hours (2.11 mm) and least value (1.65 mm) of collar diameter was observed in seeds treated with lime + jaggery solution for 24 hours. Shoot length showed significant differences between the treatments (Table 2). Seeds treated with AWD for 48 hours +

Table 1. Effect of different pre-sowing seed treatment on seed germination characteristics of *B. lanzan*

Treatment	Days to initiate germination	Days to final germination	Peak value of germination	Mean daily germination	Speed of germination	Germination (%)
T1	9	28	3.43	2.80	10.16	78.50
T2	11	28	2.72	2.39	8.51	67.00
T3	10	28	2.48	2.01	7.28	65.00
T4	10	28	2.24	1.91	7.12	53.50
T5	12	27	2.07	1.85	6.03	52.00
T6	12	28	1.39	1.28	4.18	36.00
T7	9	28	3.95	3.01	11.9	84.50
T8	-	-	-	-	-	-
T9	13	28	1.14	0.94	3.21	26.50
CD (p=0.05)	NS	NS	1.40	1.16	4.24	12.98
CV	31.48	31.22	32.47	33.24	32.84	15.27

T1-Water soaking for 72 hours; T2- Alternate wetting (12 h) and drying (12 h) two cycle for 48 h ; T3- Alternate wetting (12 h) and drying (12 h) three cycle for 72 h; T4- AWD 48 hours + $GA_3$500 ppm for 12 h; T5- Soaking seeds in lime solution for 24 h; T6-Lime+jagger solution for 24 hours; T7- Cowdung slurry for 48 hours; T8-Soaking in cow urine for 48 hours; T9-Control

Table 2. Effect of different pre-sowing seed treatment on seedling characteristics of *B. lanzan*

Treatment	Collar diameter (mm)	Root length (cm)	Shoot length (cm)	Root-Shoot ratio	Total seedling height (cm)
T1	2.08	8.98	6.94	1.29	15.91
T2	2.09	9.98	6.88	1.45	16.85
T3	2.11	9.01	6.89	1.30	15.90
T4	1.80	8.45	9.36	0.90	17.81
T5	2.16	8.18	6.36	1.28	14.54
T6	1.65	10.35	6.69	1.54	17.04
T7	1.78	10.31	7.34	1.40	17.65
T8	-	-	-	-	-
T9	1.81	8.09	6.98	1.15	15.06
CD (p=0.05)	0.27	NS	0.97	NS	NS
C.V.	9.70	23.62	9.22	-	14.32

See Table 1 for details

GA_3 500 ppm shows highest value of shoot length of 9.36 cm, followed by seeds treated with cowdung slurry for 48 hours (7.34cm) and least value (6.36 cm) of shoot length was observed in seeds treated with lime + jaggery solution. Root length, total seedling height and Quality index did not show any significance between the treatments.

AUTHORS CONTRIBUTION

Dr. Vijayalakkshmi K.P- Prepared the manuscript as well as methodology, Dr. Ramakrishna Hegde - Helped in the statistical analysis of the data and corrected the manuscript, Shashank and Sudheesh - Collected seeds and conducted the experiment

CONCLUSION

The present study revealed that the treatment of cow dung slurry for 48 hours showed the highest germination percentage (84.5%) and best pre-treatment for quality seedling production of *Buchanania lanzan.*

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