

EVALUATING THE IMPACT OF SEED PRIMING AND GROWING MEDIA ON GERMINATION OF *Feronia limonia* (Linn.)Gayatri Manoj Bhalavi¹, S. W. Choudhari², V. B. Shambharkar³, H. K. Deshmukh⁴, U. A. Raut⁵, S. S. Harne⁶ and Y. B. Taide⁷

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Abstract

The present study was conducted during 2023-24 at Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, to investigate the effect of seed priming and growing media on the seed germination of *Feronia limonia* (Linn.) S. seedling. The experiment followed a Factorial Completely Randomized Design (CRD) with twelve treatment combinations, each replicated three times. Factor A included four levels of plant growth regulators: G1 (GA₃ @ 50 ppm), G2 (GA₃ @ 100 ppm), G3 (KNO₃ @ 50 ppm), and G4 (KNO₃ @ 100 ppm). Factor B involved three growing media: M1 (Soil+ Silt+ FYM in 2:1:1 ratio), M2 (Soil+ Silt+ Vermicompost in 2:1:1 ratio), and M3 (Soil+ Silt+ Vermicompost+ Cocopeat in 1:1:1:1 ratio). Statistical analysis of the recorded data indicated that the growth regulator G2 (GA₃ @ 100 ppm) was the most effective in reducing the time to germination and enhancing germination percentage. Among the growing media, M3 (Soil+ Silt+ Vermicompost+ Cocopeat in 1:1:1:1 ratio) proved to be the most effective for both parameters. The combination treatment G2M3 showed the best results, with the shortest germination time and the highest germination percentage, making it the most suitable for promoting optimal growth of wood apple.

Key words: wood apple, growth regulator, growing media, germination

Introduction

Wood apple (*Feronia limonia* S.), a thorny deciduous tree from the family Rutaceae, is commonly known by various names across India, including elephant apple, monkey fruit, curd fruit, *kath bel*, and *kavith*. Its native range includes South India and Sri Lanka (Lande *et al.*, 2010). Historically referred to as the "poor man's food," wood apple holds significant cultural and medicinal value in India. It is distributed across several Indian states such as Maharashtra, Andhra Pradesh, Tamil Nadu, Kerala, Karnataka, Madhya Pradesh, and the western Himalayas. The tree is particularly prevalent in the Deccan Plateau, the Thane district of Maharashtra, and the S. Chanda district of Madhya Pradesh, with occurrences reported in Hazaribagh and Palamau in Chota Nagpur (Anonymous 1956). Wood apple has notable medicinal properties and is used as fodder in regions like Uttar Pradesh and Maharashtra. The tree, which can reach heights of up to 10 meters with a girth of 0.6 to 1.6 meters (Troup, 1921), features thorny branches and aromatic, carminative, and astringent leaves. A gum, resembling gum arabic, exudes from the trunk and branches. The plant is primarily propagated through seeds and vegetative methods, with seeds playing a critical role in cultivating seedling rootstocks and developing hybrid plants. However, seed germination in wood apple is often low, primarily due to factors like seed dormancy, which can be caused by hard seed coats, underdeveloped embryos, or chemical inhibitors. Dormancy hampers seed germination, reducing the plant's successful cultivation. To address this, seed priming with chemicals like GA₃ (gibberellic acid) and KNO₃ (potassium nitrate) has been explored to break dormancy and enhance germination, seedling growth, and survival. In addition to seed treatments, growing media play a vital role in seed germination and seedling development by providing essential nutrients and physical

support. The choice of growing media significantly influences water retention, drainage, and the physical and chemical properties that are crucial for seedling growth (Prajapati *et al.*, 2017). Optimizing both seed priming treatments and growing media can thus contribute to improved germination and growth of wood apple seedlings, making it an important area of research.

Material And Methods

The experiment was conducted during 2023-24 at the Main Garden, Department of Fruit Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. A Factorial Completely Randomized Design (CRD) was used with twelve treatment combinations, replicated three times. The experiment included two factors: **Factor A** was at four levels of plant growth regulators *viz.* G1 (GA₃ @50 ppm), G2 (GA₃ @100 ppm), G3 (KNO₃ @50 ppm) and G4 (KNO₃ @100 ppm), whereas **Factor B** is at three levels of growing media *viz.* M1 (Soil+ Silt+ FYM in a 2:1:1 ratio), M2 (Soil+ Silt+ Vermicompost in a 2:1:1 ratio), M3 (Soil+ Silt+ Vermicompost+ Cocopeat in a 1:1:1:1 ratio). The fresh seeds of *Feronia limonia* were collected and extracted during its season. The seeds were soaked in different plant growth regulator solutions as per the treatment levels. After soaking, the seeds were dried in the shade and sown in 2 cm deep into 5x8 inch polythene bags. The bags were filled with the respective growing media, prepared according to the predefined proportions of soil, silt, FYM, Vermicompost, and Cocopeat at the experimental site. Five representative seedlings from each treatment combination were selected for observation. Various germination parameters were recorded to assess the effects of seed priming and growing media on seed germination and early seedling growth.

Treatment details :

Factor A: Growing regulator

G1 : GA₃ @50 ppm
G2 : GA₃ @100ppm
G3 : KNO₃ @50 ppm
G4 : KNO₃ @100 ppm

Factor B: Growing media

M1 : Soil+ Silt+ FYM (2:1:1)
M2 : Soil+ Silt+ Vermicompost (2:1:1)
M3 : Soil+ Silt+ Vermicompost+ Cocopeat (1:1:1:1)

The seeds sown in polybags for each treatment were observed daily to record the seed germination starting from the date of sowing. The time required for germination was calculated as the number of days between the date of sowing and the emergence of the plumule. Germination percentage was determined using the following formula:

$$\text{Germination percentage (\%)} = \frac{\text{Number of seeds germinated}}{\text{Total number of seeds sown}} \times 100$$

Result And Discussion**Days to Germination**

The data indicated that the minimum number of days required for seed germination (6.75 days) was recorded with the treatment GA₃ @ 100 ppm (G2). In contrast, the maximum number of days required for germination (9.96 days) was observed with the KNO₃ @ 50 ppm (G3) treatment. The earlier germination in the GA₃-treated seeds can be attributed to the role of GA₃ in activating cytological enzymes, which leads to increased energy production and the availability of substrates necessary for growth. This process enhances the structural components essential for embryo emergence and improves cell wall plasticity, allowing better water absorption. Similar findings have been reported by Panda *et al.* (2018) in kagzi lime, Anand B. *et al.* (2012) in *Melia dubia*, and Patel *et al.* (2016) in custard apple.

Regarding the growing media, the treatment M3 (Soil+ Silt+ Vermicompost+ Cocopeat in 1:1:1:1) resulted in the shortest

germination time (7.35 days). The maximum days to germination (9.00 days) were recorded with M1 (Soil+ Silt+ FYM). The enhanced performance of M3 may be due to its superior water-holding capacity, moisture retention, and adequate porosity, which promotes sufficient gaseous exchange and moisture availability to the seeds, thereby shortening the germination period. These results align with those of Sajana *et al.* (2018) in *Semecarpus anacardium* and Parmar *et al.* (2019) in Jamun.

Among the different combinations of growth regulators and growing media, the treatment G2M3 (GA₃ @ 100 ppm with Soil+ Silt+ Vermicompost+ Cocopeat in a 1:1:1:1 ratio) showed the minimum days to germination (6.20 days), whereas maximum days to germination (10.94 days) were observed in the treatment G3M1 (KNO₃ @ 50 ppm with Soil+ Silt+ FYM at 2:1:1 ratio). **Table 1.** Interaction effect of different growth regulator and growing media on days to germination of *Feronia limonia* seeds.

Treatments	Growth regulator (A)				
Growing media (B)	G1	G2	G3	G4	Mean B
M1	7.46	7.13	10.94	10.46	9.00
M2	7.40	6.93	10.46	9.43	8.55
M3	6.76	6.20	8.46	8.00	7.35
Mean A	7.21	6.75	9.96	9.30	
Factors	Factor (A)	Factor (B)	Factor (AXB)		
S.E.(m)±	0.09	0.08	0.17		
C.D. at 5%	0.29	0.25	0.50		
F test	Sig.	Sig.	Sig.		

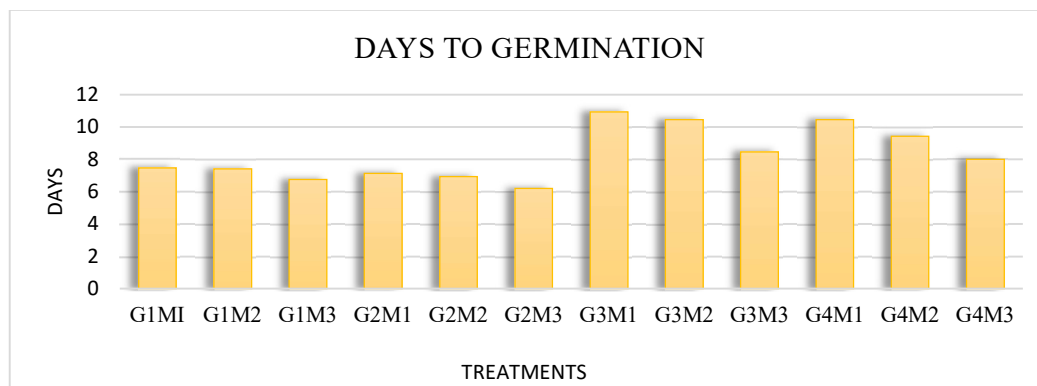


Fig.1: Performance of different treatment combinations on days to germination of *Feronia limonia* seeds

Germination Percentage (%)

The data presented in Table 2 clearly indicate that the treatment GA₃ @ 100 ppm (G2) achieved the highest germination percentage (83.38%). The significantly lowest germination percentage (59.72%) was recorded with the KNO₃ @ 50 ppm (G3) treatment. This increased germination rate with GA₃ treatments can be attributed to its role in stimulating the synthesis of hydrolytic enzymes, such as amylase and protease, in the embryo. These enzymes break down stored food reserves, making them available for embryo growth, thus enhancing germination. Similar findings have been reported by Parmar *et al.* (2019) in Jamun, Sau *et al.* (2019) in wood apple, and Rout *et al.* (2020) in Bael.

Among the growing media treatments, the maximum germination percentage (76.70%) was observed in M3 (Soil+ Silt+ Vermicompost+ Cocopeat at 1:1:1:1 ratio). The lowest germination percentage (64.79 %) was recorded in M1 (Soil+ Silt+ FYM at 2:1:1 ratio). This

improvement in germination can be attributed to the superior water-holding capacity, moisture retention, and porosity of M3, which provide optimal conditions for seed germination. The adequate moisture supply, ideal soil temperature, and proper gaseous exchange between the media and the seeds, along with the presence of organic acids in the media containing organic manures, may have contributed to the enhanced germination. Similar results were reported by Biradar *et al.* (1998) in neem, Sajana *et al.* (2018) in *Semecarpus anacardium*, and Nanita B. *et al.* (2021) in *Gmelina arborea*.

The interaction effect between plant growth regulators and growing media on germination percentage was found to be significant (Table 2). Among the different treatment combinations, the highest germination percentage (88.48%), whereas the lowest germination percentage (54.16%) was recorded in the combination KNO₃ @50 ppm + Soil+ Silt+ FYM in 2:1:1 ratio (G3M1) treatment.

Table 2 : Interaction effect of different growth regulator and growing media on germination percentage (%) of *Feronia limonia* seeds.

Treatments	Growth regulators (A)				
Growing media (B)	G1	G2	G3	G4	Mean B
M1	70.00	78.33	54.16	56.66	64.79
M2	75.83	83.33	59.16	63.33	70.41
M3	85.83	88.48	65.83	66.66	76.70
Mean A	77.22	83.38	59.72	62.22	-

Factors	Factor (A)	Factor (B)	Factor (AXB)
S.E.(m)±	0.57	0.49	0.98
C.D. at 5%	1.67	1.45	2.88
F test	Sig.	Sig.	Sig.

Conclusion

Based on the experimental results, it can be concluded that the application of GA₃ @ 100 ppm as a plant growth regulator, combined with the growing media of Soil+ Silt+ Vermicompost + Cocopeat (1:1:1:1), significantly improves the germination of wood apple seeds. This combination not only reduced the number of days to germination but also resulted in the highest germination percentage. The interaction between GA₃ @ 100 ppm and the Soil+ Silt+ Vermicompost + Cocopeat (1:1:1:1) media was found to be the most effective and suitable method for raising healthy wood apple seedlings, making it a recommended practice for improving seedling growth and establishment.

References

1. Anand, B., G.M. Devagiri, G. Maruti, H.S. Vasudev and A.K Khaple (2012). Effects of pre-sowing seed treatments on germination and seedling growth performance of *Melia dubia* Cav: An important multipurpose tree. Int. J. of Life Sciences:1(3):59-63.
2. Anonymous (1956). The wealth of India (Vol. 4, pp 18). New Delhi: Council of Scientific and Industrial Research (CSIR).
3. Biradar, A.P., S.B. Deveranavadagi, R.G. Teggelli, R.A. Baolikai, J.M. Nidagundi, and S.M. Vastard (1998). Effect of Vermicompost as potting media mixture on growth and vigour of neem seedlings (*Azadirachta indica*). Advances in Forestry Research in India, 16:84-89.
4. Lande, S.B., V.S. Nirmal and P.M Kotecha (2010). Studies on preparation of ready-to-serve beverages from wood apple pulp. *Beverages and Food World*, 37(4):69-70.
5. Nanita, B., A. Shukla and E. Barkade (2021). Pre-sowing treatment of seeds and its impact on germination of *Gmelina arborea* Roxb. The Pharma. Innovation J., 10(10): 239-243.
6. Panda, P. A., A.K Karna and K. Sinha (2018). Effect of gibberellic acid (GA₃) on seed germination and growth of kagzilime (*Citrus aurantifolia* Swingle). International J. of Chemical Studies, 6(5): 2803-2805.
7. Parmar, P J., K. M. Karetha, H P. Purohit, S Mishra, and V. L. Purohit (2019). Effect of GA₃ and growing media on seedling growth of jamun (*Syzygium cumini* L.) cv. Local. Bull. Env. Pharmacol. Life Sci., 8 (12): 52-59
8. Patel, D.D., S.S. Gaikwad and K. Patel (2016). Effect of seed priming treatments on germination and seedling vigour of custard apple (*Annona squamosa*). Current Horticulture, 4(2):21-24.
9. Prajapati, D. G, B.N. Satodiya, A.B. Desai and P.K Nagar (2017). Influence of storage period and growing media on seed germination and growth of acid lime seedlings (*Citrus Aurantifolia* Swingle) cv. Kagzi. Journal of Pharmacognosy and Phytochemistry, 6(4):1641-1645.
10. Rout, S., S. Beura, S. Nayak, and S. Kar, (2020). Influence of Gibberellic Acid (GA₃) different concentrations on Seedling Growth of Bael (*Aegle marmelos* L.), Ind. J. Pure App. Biosci., 8(4): 125-128.
11. Sajana, S., G.R. Munde and A.H. Shirsath (2018). Effect of growing media on seed germination and seedling growth of marking nut (*Semecarpus anacardium*). Plant Archives, 18, Special Issue (ICAAAS-2018):19-26.
12. Sau, S., B. Pal, S. Sarkar, and T. Sarkar (2019). Influence of Seed Priming on Germination and Seedling Vigour of Wood Apple (*Feronia limonia* Swingle). IJBMS., :128-36.
13. Troup, R.S. (1921). In the Silviculture of Indian trees, Vol. III, Govt. of India: 101-103.