

INFLUENCE OF DIFFERENT PRE-TREATMENTS METHODS ON SEED GERMINATION AND SEEDLING GROWTH PERFORMANCE OF GOLDEN SHOWER TREE (*CASSIA FISTULA* L.)

Chanchithung T. Humtsoe, Neelam Khare, Sandeep Rout* and Ronald Debbarma

College of Forestry, Sam Higginbottom University of Agriculture Technology & Sciences, Prayagraj, Uttar Pradesh, INDIA.

Email: sandeeprou1988@gmail.com

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Abstract: The present study was conducted to find out the effect of different pre-treatments method on seed germination and seedling growth performance of Golden Shower Tree (*Cassia fistula* L.) at Forest nursery and Research Centre, SHUATS, Allahabad, India, during the month of June – September 2018. The seeds were pre-treated with different methods such T₀- Control, T₁- hot water 20 min + soaking in cold water 12 hrs, T₂- cold water 24 hrs, T₃- IAA 200 ppm 12 hrs, T₄- IBA 200 ppm 12 hrs, and T₅- Conc H₂SO₄- 2 Min+ 16 Hrs soaking in cold water and sown in poly bags filled with FYM 2:1:1 at Completely Randomized Design. The results indicated the maximum Germination percentage (78.89), Number of leaves (6.49) at 30 DAS, 7.29 AT 60 DAS, 9.21 at 90 DAS, shoot height (25.25 cm) at 90 DAS, root length (17.77cm), fresh shoot weight (7.27g), dry shoot weight (3.82g), fresh root weight (4.38g), dry root weight (2.78g) and vigour index (121.89) recorded in T₅. However T₀ Control had no germination. Therefore, the results showed that the best pre-treatment method T₅ was more effective in germination and significantly improved the growth parameters as well as the quality seedling of *Cassia fistula* L.

Keywords: *Cassia fistula*, Pre-treatment, Seed germination, Seedling growth

INTRODUCTION

India is blessed with a storehouse of natural flora and fauna. It's calculable that there are more than 45,000 plant species in India. It is estimated that over 6000 plants in India are in use in traditional, folk and herbal medicine (Danish *et al.*, 2011). Among these 866 species are considered to be the potential medicinal plants in Indian trade. India officially recognizes over 3000 plants for their medicinal value. World health Organization reported that traditional medical practitioners treat about 85 per cent of patients in India (WHO survey, 1993), which shows the significant valuable relation between local tribal people with medicinal plants. The WHO estimated that 80 per cent of the population of developing countries depends on traditional medicines. Among which India's contribution is 15-20 per cent and in India about 2000 drugs used are of the plant. The pod of *C. fistula* has been used as a laxative drug in Thai ancient drugs for a protracted time.

The degree of laxative potency is dependent on the content of anthraquinone glycosides. The plant contains anthraquinone glycosides as both glycones and glycosides has been used as an alternate supply of stuff for numerous flavouring laxative medication preparations (Sakulpanich and Gritsanapan, 2009). *C. fistula* leaf appear to be potential sources of anti-obesity and hypolipidemic compounds which could be developed as phytomedicines or drugs (Christine *et al.*, 2011). Leaf and Root Extract of *Cassia fistula* may play a helpful role within the management of bacterial infections (Awal *et al.*,

2010). The tree is distributed naturally throughout the tropical and subtropical regions of India.

Golden Shower Tree (*Cassia fistula* L.) is a member of the family *Caesalpinaceae* known for its characteristic bunches of beautiful yellow flowers and grows throughout India. The tree is a native plant of India, naturalized in Africa, West Indies and South America. It's earned importance as a decorative and avenue plant (Arora, 1988). This species has been introduced in different plantation programs like agro-forestry, community forestry, social forestry, village and farm forestry in different parts of Bangladesh (Khan *et al.*, 2006). It is a fast-growing tree which reaches 30 to 40 feet in height.

The well-spaced branches are clothed with pinnately compound leaves, with leaflets up to eight inches long and 2.5 inches wide. These leaves will drop from the tree for a short period of time and are quickly replaced by new leaves. In summer, Golden-Shower is decorated with thick clusters of showy yellow blooms which cover the slightly drooping branches. The blooms are followed by the production of two-foot-long, dark brown, cylindrical pods which persist on the tree (Gilman and Watson, 1993). Its leaves, stem, bark and pods having antibacterial and antifungal activity (Duraipandiyar and Ignacimuthu, 2007).

The pods of *C. fistula* L. are straight cylindrical pods, 20-60 cm long and 1.5-2 cm in diameter. The pod is dark green when young, turning dark brown to black when mature. The ripe pod contains dark color sweetish pulp and numerous yellowish-brown seeds. The pods should be collected when ripe and carefully dried. The best pods are those which do not rattle

*Corresponding Author

when shaken. These possess the most pulp. The pulp of ripe pods and mature leaves are known to have laxative drug property (Gritsanapan, 2010). The leaf extract *C. fistula* has potent mosquito larvicidal property (Mehdi *et al.*, 2011).

The importance of seed treatment is that it helps to resolve seed dormancy. Seed treatment chemicals also have been shown to increase germination rates, vigor and root development. The use of this service is important to ensure the seed is not undertreated and risking the loss of protection, or over-treated, which wastes money and affects seed health. When you are treating the seed with the essential nutrients, there are a number of advantages that you have. The first one is of course higher germination of plants (Rout *et al.*, 2017; Rout *et al.*, 2016; Dilip *et al.*, 2017; Singh *et al.*, 2016).. Keeping in the view above mentioned constraints, the topic entitled "Effect and variations of different Pre-treatments on seed germination of Golden Shower Tree (*Cassia fistula* L.).

MATERIALS AND METHODS

The experimental studies entitled were carried out in the Forest Nursery and Research Centre, College of Forestry, Sam Higginbottom Institute of Agricultural, Technology and Sciences, Prayagraj 211007 (U.P) during the period of June 2018- September 2018. The experimental treatments consisted of T₀- Control, T₁- hot water 20 min + soaking in cold water 12 hrs, T₂- cold water 24 hrs, T₃- IAA 200 ppm 12 hrs, T₄- IBA 200 ppm 12 hrs, and T₅- Conc. H₂SO₄- 2 Min+ 16 Hrs soaking in cold water, and 4 replications for each treatment. The experiment was conducted at the Forest Nursery and Research Centre, College of Forestry, SHUATS, Prayagraj 211007 Uttar Pradesh which is situated 6kms away from Allahabad city on the right bank of Yamuna river, the experimental site is located in the sub-tropical region with 25 57' N latitude, 81 57' E longitude and 98 meters above the mean sea level. All the necessary facility including labor was readily available in the College. Prayagraj is very close to the reference point for IST (Indian Standard Time), it is 2.6 minutes behind IST. The climate in this part of the country has been classified as semi-arid with both the extent of temperature during the winter and summer. From December to January, the temperature may drop down to as low as 2° C, while it may exceed 47° C during May-June. Frost during winter and hot air during summer are common occurrences. The average annual rainfall is about 102 cm with maximum concentration during July to September and with occasional showers during the winter season (Patra *et al.*, 2016). A total of 180 seeds were used with 30 seeds allocated for each treatment. The seeds were subjected to best pre sowing treatment (including control) after which they were germinated in poly bags. Then the pre-treated seeds were sown in poly bags with a mixture of Soil,

Sand and FYM (2:1:1) in a completely randomized block design with the treatments. One seed was sown in each poly bag. The seeds were then be watered daily to provide moisture that helped in the germination of the seeds. The poly bags were arranged in accordance with the treatment. The germination was recorded daily and seedling growth from each treatment was recorded accordingly at an interval of 30 days each. Data were recorded for the No of seed germinated, number of leaves/plant at 30, 60, 90 DAS, shoot height at 30, 60 and 90 DAS, root length (cm), fresh weight of shoot (g), fresh weight of root (g), dry weight of shoot (g), dry weight of root (g) and vigour indexed were calculated (Abdul and Anderson, 1973). The data obtained from the experiment was statistically analyzed by an appropriate procedure to completely randomized design (CRD) as described by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

Seed germination percentage (%)

The result of the present experiment indicates that germination started earlier in T₅, T₄, T₃, T₁, T₂ However T₀ Control did not have any germination. In all treatments, germination completed within 10-20 days after sowing the seeds in the polybags. The data for germination percentage recorded at successive stages of Golden shower tree is presented in table 1(a). Results revealed highly significant differences ($p < 0.05$) between different pre-treatment methods on germination percentage. Data appended in table 1 (a) revealed that the germination percentage showed significant difference with all the treatments. The average germination percentage was observed maximum in T₅ (78.89%). The minimum was seen at T₀ at (0.00%). The second best treatment was T₄ (72.23%), T₃ (68.89%), T₂ (65.56%), T₁ (62.23%). The positive effects of H₂SO₄ on germination percentage of *Cassia fistula* were also found by Zarchini *et al.*, (2011) who reported that H₂SO₄ pre treatment resulted in higher seed germinations.

Number of leaves

Persual of the data appended in table 1(a) revealed that the number of leaves was significantly influenced by different pre-treatment methods at a different stage of the growth of the seedlings.

Data appended in table 1(a) revealed that after 30 DAS, it was found that the number of leaves show significant differences among all the treatments. However, the average number of leaves after 30 days was observed maximum in T₅ (6.49) followed by T₃ (6.47) and the minimum was recorded in T₀.

It was revealed from table 1(a) that after 60 DAS, it was found that the number of leaves show significant differences among all the treatments. However the average number of leaves after 60 days was observed maximum in T₅ (7.29) followed by T₃ (7.27) and the minimum in T₀.

After 90 days it was found that the number of leaves shows significant difference among all treatments. However the average number of leaves after 90 days observed maximum in T₅ (9.21) followed by T₃ (8.17) and the minimum in T₀. Supporting results were obtained by Mabundza *et al.*, (2010) in *Tamarindus indica* L. with 95% H₂SO₄ for 5 Min seed pre treatment enhanced the seed germination and the number of leaves.

Shoot height (cm)

In general the plant height increased with age of the plant. However, margin of increase was highest after the 60 days period of sowing irrespective treatments. Perusal to the data appended in table 1(a) revealed that after 30 DAS. It was found that the shoot height shows significant differences among all treatments. The average plant height was observed maximum in T₅ (16.93) followed by T₄ (13.83) and the minimum in T₀.

From the table 1(a) revealed that after 60 DAS, it was found that the shoot height shows significant differences among all the treatments. However the average shoot height after 60 days was observed maximum in T₅ (23.43) followed by T₃ (19.83) and the minimum in T₀.

After 90 days it was found that the shoot height shows significant difference among all treatments. However the average shoot height after 90 days observed maximum in T₅ (25.23) followed by T₃ (20.33) and the minimum in T₀. Similar results were also obtained by Agbogid *et al.*, (2007) who demonstrated that acid pre treatment of *D. edulis* has the highly significant effect of improving seed viability and enhances seedling emergence and growth.

Root length (cm)

Given on the data in table 1(b) revealed that the root length of the seedlings was significantly influenced by different pre-treatment methods at different stages of the growth of seedlings.

Data appended in table 1(b) revealed that after 90 DAS, it was found that the root length of the seedlings showed a significant difference among all the treatments. However the average root length of the seedlings after 90 days was observed maximum in T₅ (17.77) followed by T₄ (15.37) and the minimum was recorded in T₀. The results are in agreements with those obtained by Anim Kuapong and Teklehaimanot (2001) who found that root length significantly affected by treatment and length of root was recorded in seed *Albizia zygia* scarified by H₂SO₄ for 5 Min.

Fresh weight of Shoot (g)

Given data table 1(b) revealed that the fresh weight of shoot was significantly influenced by different pre-treatments methods at different stages of the

growing seedlings. Data appended in table 1(b) revealed that after 90 DAS, it was found that the fresh shoot weight of the seedlings showed significant differences among all the treatments. However the average fresh weight of shoot of the seedlings after 90 days was observed maximum in T₀.

Dry weight of shoot (g)

Given data in appended in table 1(b) revealed that dry weight of shoot of the seedlings was significantly influenced by different pre-treatment methods at different stages of the growth of seedlings. Data appended in table 1(b) revealed that after 90 DAS. It was found that the dry weight of shoot of the seedlings showed significant differences with all the treatments.

However the average dry weight of shoot of the seedlings after 90 days was observed maximum in T₅ (3.82) followed by T₄ 3.06 and the minimum recorded in T₀.

Fresh weight of root (g)

Perusal of the data appended in table 1(b) revealed fresh root weight of seedlings was significantly influenced by different pre-treatment methods at different stages of the growth of seedlings. Data appended in the table 1(b) revealed that after 90 DAS. It was found that the fresh weight of root of the seedlings showed significant differences among all the treatments. However the average root weight of seedlings after 90 days was observed maximum in T₅ (4.38) followed by T₄ (4.08) and the minimum recorded at T₀.

Dry weight of root (g)

Given data in table 1(b) revealed that dry weight of root the seedlings was significantly influenced by different pre-treatment methods at different stages of the growth of seedlings. Data appended in table 1(b) revealed that after 90 DAS, it was found that the dry weight of root of the seedlings showed significant difference with all the treatments. However that average dry root weight of seedlings after 90 days was observed maximum in T₅ (2.78) followed by T₄ (2.36) and minimum in T₀. Gupta *et al.*, (2001) showed that different treatment H₂SO₄ treated for 5 min was the most effective in breaking the dormancy which was imposed by the seed coat in *Abutilon indicum*.

Vigour Index (VI)

Given in table 1(b) revealed that vigour index of the seedlings was significantly influenced by different pre-treatments methods at different stages of the growth of seedlings.

Data appended in table 1(b) revealed that after 90 DAS, it was found that vigour index of the seedlings showed significant differences among all treatments. However the average vigour index of seedling after 90 days was observed maximum.

Table 1. Effect of various pre-treatment methods on seedling growth of Golden Shower Tree (*Cassia Fistula L.*)

S. No.	Treatments	Germination (%) average	No. of leaves @ 30 DAS	No. of leaves @ 60 DAS	No. of leaves @ 90 DAS	Shoot height @ 30 DAS (cm)	Shoot height @ 60 DAS (cm)	Shoot height @ 90 DAS (cm)
1	T ₀ -Control	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	T ₁ - hot water 20 min + soaking in cold water 12 hrs	62.23	6.22	6.88	7.08	12.43	15.03	15.73
3	T ₂ - cold water 24 hrs	65.56	6.12	7.18	8.00	11.43	16.03	16.73
4	T ₃ - IAA 200 ppm 12 hrs	68.89	6.47	7.27	8.17	11.53	17.43	18.93
5	T ₄ - IBA 200 ppm 12 hrs	72.23	4.61	5.81	8.11	13.83	19.83	20.33
6	T ₅ - Conc. H ₂ SO ₄ - 2 Min+ 16 Hrs soaking in cold water	78.89	6.49	7.29	9.21	16.93	23.43	25.23
	C. D. (P = 0.05)	1.86	0.13	0.80	0.74	0.76	1.14	1.52

Table 1. Effect of various pre-treatment methods on seedling growth of Golden Shower Tree (*Cassia Fistula L.*)

S. No.	Treatments	Root length (cm)	Shoot fresh weight average(g)	Shoot dry weight average (g)	Root fresh weight average (g)	Root dry weight average (g)	Seed vigour index
1	T ₀ -Control	0.00	0.00	0.00	0.00	0.00	0.00
2	T ₁ - hot water 20 min + soaking in cold water 12 hrs	9.67	3.87	2.27	3.26	2.04	87.63
3	T ₂ - cold water 24 hrs	14.37	4.97	2.73	3.43	2.17	96.66
4	T ₃ - IAA 200 ppm 12 hrs	14.07	5.25	2.94	3.96	2.25	101.89
5	T ₄ - IBA 200 ppm 12 hrs	15.37	5.67	3.06	4.08	2.36	107.93
6	T ₅ - Conc. H ₂ SO ₄ - 2 Min+ 16 Hrs soaking in cold water	17.77	7.27	3.82	4.38	2.78	121.89
	C. D. (P = 0.05)	1.52	0.73	0.37	0.74	0.45	15.17

CONCLUSION

Based on the above results, it is concluded that the seeds which were treated in concentrated H₂SO₄ for 2 minutes + 16 hrs cold water performed significantly better than the other treatments. Beside, seedling growth was found more effective in respect to faster germination, higher germination percentage and dry matter production compared to the other applied pre-treatments. Considering that the seeds of *Cassia fistula L.* have a very hard seed coat and almost impermeable to water or moisture, the acid helps to

resolve the seed dormancy and quality seedling production of this ornamental tree species.

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