The Pharma Innovation Journal 2023; 12(8): 2742-2745

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(8): 2742-2745

www.thepharmajournal.com
Received: 20-05-2023
Accepted: 27-06-2023

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Influence of hormones and cutting types on rooting and establishment of Gliricidia [*Gliricidia sepium* Jecq.]

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Abstract

The present investigation was carried out in 2022 at the College of Forestry, Navsari Agricultural University, Navsari, Gujarat. The experiment conducted in completely random design and a factorial concept that included the rooting hormones IBA, NAA, and their combinations as one factor and second factor of cutting types along with three repetitions. Among various rooting hormone treatments, combination of IBA and NAA @ 1000 ppm + 1000 ppm concentration recorded high value of shoot length (52.96 cm), number of leaves per cutting (248.85), number of shoots per cutting (2.01) at 150 DAP, root length (42.26 cm), number of primary roots per plant (9.60), fresh weight of root and shoot (5.63 and 74.95 g plant^{-1}, respectively), dry weight of root and shoot (2.64 and 18.21 g plant^{-1}, respectively) with earlier days to sprout and days to 50% sprout (8.61 days and 13.57 days, respectively), while lower values of above all parameters were recorded in Control. Between the types of cutting, hardwood cutting recorded maximum shoot length (49.00 cm), maximum number of leaves per cutting (235.02), number of shoots per cutting (4.40) at 150 DAP, root length (25.52 cm), number of primary roots per plant (7.05), fresh weight of root and shoot (3.11 and 62.06 g plant^{-1}, respectively), dry weight of root and shoot (1.63 and 14.42 g plant^{-1}, respectively with minimum number of days to sprouting and days to 50% sprout (9.91 days and 14.86 days, respectively); furthermore, lower values of all these parameters were recorded in softwood cutting. In case of interaction effect, significantly minimum days to sprout were found in treatment combination of T_{11}: IBA 750 ppm + NAA 750 ppm with C_1: Hardwood cutting (7.84 days). Whereas, significantly maximum number of shoots at 150 DAP was observed in treatment combination of T_5: IBA 2000 ppm with C_1: Hardwood cutting (2.04). Moreover, significantly maximum root length was found in treatment combination of T_{12}: IBA 1000 ppm + NAA 1000 ppm with C_1: Hardwood cutting (44.74 cm).

Keywords: *Gliricidia sepium*, cutting types, rooting hormones, establishment

Introduction

Gliricidia sepium Jecq., belongs to Fabaceae family. It is small to medium-sized rapidly growing semi-deciduous tree with a crown that spreads widely. This multipurpose tree typically branches out from the base, with a basal diameter of 50 to 70 cm. The stem with branches is frequently flecked with tiny white lenticels, and the smooth bark can range in hue from light grey to deep red brown. (Rao *et al.*, 2011) [7]. Gliricidia is one of the most widespread and well-known trees in many tropical regions of Central America, Mexico, West Africa, the West Indies, South Asia, and the Americas. It is currently grown all across the tropical world, and it grows most in dry climates. The tree admires deep, well-drained soils but may withstand shallow or skeletal soils with high levels of available calcium. Due to its ability to grow on slightly salinated calcareous soils, gliricidia is suitable for cultivation in all circumstances. According to Wani *et al*. (2009) [14], gliricidia often spreads through seeds and adapts well to a variety of soil types, including eroded acidic (pH 4.5-6.2) soils, fertile sand soils, heavy clay soils, calcareous limestone soils, and alkaline soils. When the rains start, the fire-resistant tree species gliricidia immediately sprouts new growth. (Rao *et al*., 2011) [7]. Typically, the tree is used for a number of things, including green manure, timber, fuel, hedges, charcoal, live fence, shade, and ethnomedical purposes. Additionally, Gliricidia is frequently utilized as a fallow tree to restore degraded land, a live fence post for pasture, and for providing shade for cocoa, coffee, and other sciophytic crops. The tree is a valuable source of fuelwood, feed, and green manure. While small and large cuttings make it relatively simple for farmers to reproduce quickly, seed propagation is easier. After *Leucaena leucocephala*, it is perhaps the most frequently grown multipurpose agroforestry tree. (Simons and Stewart, 1994) [12]. Because there are few standardized propagation techniques for propagating gliricidia, which have a variety of advantages, the current research was carried out to determine how hormones and cutting kinds affect gliricidia sprouting and establishment.

Materials and Methods

This research was carried out at the College of Forestry's Net House at Navsari Agricultural University in Navsari, Gujarat. during July to December 2022. In the present trail, different types of cuttings *viz.,* Hardwood. Semi hardwood and Softwood cuttings of *G. sepium* treated with different growth hormones *i.e.,* T_1: Control, T_2: IBA 500 ppm, T_3: IBA 1000 ppm, T_4: IBA 1500 ppm, T_5: IBA 2000 ppm, T_6: NAA 500 ppm, T_7: NAA 1000 ppm, T_8: NAA 1500 ppm, T_9: NAA 2000 ppm, T_{10}: IBA 500 ppm + NAA 500 ppm, T_{11}: IBA 750 ppm + NAA 750 ppm, T_{12}: IBA 1000 ppm + NAA 1000 ppm were adopted. Cuttings were dipped for 10 minutes in solution after that immediately raised in polybags (5 x 7 inch) filled with Soil, Sand and FYM in proportion of 2:1:1 as growing media in shade net house with Completely Randomized Design with factorial concept (FCRD). Daily observation taken for sprouting and days to 50% sprouting whereas shoot length, number of leaves and number of shoots were measured at monthly interval up to 5 months and rooting parameters, survival percentage and biomass were calculated at 150 DAP (Days After Planting).

Results and Discussion

The data on sprouting, growth, rotting and biomass of *G. sepium* treated with various concentration of rotting hormones and cutting types are presents in Table 1 and 2. From various concentration of rooting hormones early sprouting (8.61 days) and days to 50% sprout (13.57 days) recorded in treatment T_{12}: IBA 1000 ppm + NAA 1000 ppm as compare to treatment T_1: Control of 12.26 days and 16.48 days, respectively. Among the different cutting types minimum days to sprout and days to 50% sprout were found in C_1: Hardwood cutting (9.91 days and 14.86 days, respectively). In interaction effect of rooting hormones and cutting types early sprouting was recorded maximum in T_{11}: IBA 750 ppm + NAA 750 ppm with C_1: Hardwood cutting (7.84 days) while minimum in T_1: Control with C_3: Softwood cutting (12.61 days). An enhanced capacity of the hardwood to use its stored nitrogen and carbohydrates, along with the the infusion of auxin, which promoted cell division and higher auxin concentration in cells, may have resulted to the early sprouting. (Chauhan and Reddy, 1971) [1]. Similar findings have been reported for grape by Patil *et al.,* (2000) [6], phalsa by Singh and Bahadur (2015) [13], and pomegranate by Seiar (2017) [11].

In terms of growth parameters, treatment T_{12}: IBA 1000 ppm + NAA 1000 ppm produced the highest shoot length (52.96 cm), number of leaves per cutting (248.85), and number of shoots per cutting (2.01), while treatment T1: Control produced the minimum values of 38.72 cm, 207.59 cm, and 1.86 cm, respectively. The C_1: Hardwood cutting had the highest average shoot length (49 cm), the highest number of leaves per cutting (235.02) and the maximum number of shoots per cutting (2.01), all at 150 DAP, whereas the C3: Softwood cutting had the minimum values (46.38 cm, 224.16, and 1.94, respectively). The treatment combination of T_5: IBA 2000 ppm with C_1: Hardwood cutting produced the highest number of shoots at 150 DAP (2.04) while T_1: Control and C_3: Softwood cutting produced the least number of shoots (1.66). This could be assigned to increased cell division and elongation at higher IBA concentrations, which ultimately raised the activation of shoot growth and may possibly have increased the number of nodes, which in turn led to the formation of more leaves (Seiar, 2017) [11]. Furthermore, hardwood cuttings produced the best growth characteristics, maybe because they contained more food reserves than semi-hardwood and softwood cuttings (Rathwa *et al*., 2017) [8]. Similar findings in fig, phalsa, pomegranate, and pomegranate were also reported by Reddy *et al.,* (2008), Singh and Bahadur (2015) [13], Seiar (2017) [11], and Rathwa *et al*., (2017) [8].

In treatment T_{12}: IBA 1000 ppm + NAA 1000 ppm, the maximum root length (42.26 cm) and the number of primary roots (9.60) were discovered, whereas the smallest values were observed in treatment T_1: Control, *i.e.,* 13.77 cm and 2.88, respectively. Significantly, C_1 hardwood cutting was 25.52 cm in root length and 7.05 primary roots, respectively, while C_3 softwood cutting measured 21.54 cm and 5.05, respectively. Maximum root length was discovered in the treatment combination of T_{12}: IBA 1000 ppm + NAA 1000 ppm with C_1: Hardwood cutting (44.74 cm), whereas minimum root length was discovered in the treatment combination of T_1: Control with C_3: Softwood cutting (12.27 cm). In comparison to individual rooting hormones, cuttings treated with a combination of rooting hormones (IBA+NAA) showed maximum root length and more primary roots per plant. It might be caused by the growth of root primordia (Tissue from which a root can grow), and root development in plants of the Gliricidia species may be greatly increased through the use of rooting hormones. Due to more starch and early shoot sprouting on hardwood cuttings, which in turn provides favorable conditions for root initiation and increased root length, the longest root length was observed among cutting types (Ratnamala, 2013). These findings are analogous with earlier findings discovered by Singh and Bahadur (2015) [13] in phalsa, Reddy *et al.,* (2008) [10] in lime and Reddy *et al.,* (2008) [10] in *Ficus carica*.

In treatment T_{12}: IBA 1000 ppm + NAA 1000 ppm, the maximum fresh weight and dry weight of the root, 5.63 and 2.64 g plant^{-1}, and the shoot, 74.95 and 18.21 g plant-1, were observed, respectively. These attributes were recorded at their lowest levels in treatment T_1: Control, 1.26 and 0.68 g plant^{-1}, and 42.07 and 6.49 g plant^{-1}, respectively. In terms of cutting types, C_1: Hardwood cutting had the highest fresh weights (3.11 and 62.06 g plant^{-1}), whereas C_3: Softwood cutting had the lowest fresh weights (1.63 and 14.42 g plant^{-1} for root and shoot, respectively). The fresh weight of the roots has been directly influenced by the length and quantity of roots (Ingle and Venugopal, 2009) [2]. The hardwood cutting had the highest fresh weight and dry weight among all the other types of cuttings. The quantity of roots and shoots in each cutting directly relates to the fresh weight of the root and shoot. The longer roots and accumulation of more carbohydrates in storage, as well as the larger number of roots that increased their volume per cutting of the roots in hardwood cutting, may be to responsible for the higher weight of roots. (Milind, 2008) [5]. Similar effect has also been observed in azalea by Maryam *et al*. (2014) [4]; in pomegranate by Seiar (2017) [11] and in lime by Malakar *et al*. (2019) [3].

Table 1: 1 Influence of hormones and cutting types on sprouting and growth of Gliricidia

Hormone treatments (T)	Days to sprout	Days to 50% sprout	Increased shoot length (cm) at 150 DAP	Number of leaves per cutting at 150 DAP	Number of shoots per cutting at 150 DAP
T_1: Control	12.26	16.48	38.72	207.59	1.86
T_2: IBA 500 ppm	11.16	16.04	45.42	219.05	1.96
T_3: IBA 1000 ppm	10.53	15.39	47.43	227.45	1.98
T_4: IBA 1500 ppm	10.00	15.13	49.21	235.54	1.98
T_5: IBA 2000 ppm	9.52	14.49	50.27	240.15	1.99
T_6: NAA 500 ppm	11.74	16.15	43.91	212.20	1.96
T_7: NAA 1000 ppm	10.69	15.47	46.12	225.45	1.97
T_8: NAA 1500 ppm	10.34	15.29	47.95	230.98	1.98
T_9: NAA 2000 ppm	10.24	15.18	49.09	234.01	1.98
T_{10}: IBA 500 ppm + NAA 500 ppm	9.64	15.10	49.89	236.94	1.99
T_{11}: IBA 750 ppm + NAA 750 ppm	8.68	14.23	51.27	244.88	2.00
T_{12}: IBA 1000 ppm + NAA 1000 ppm	8.61	13.57	52.96	248.85	2.01
SEm ±	0.243	0.286	0.88	2.87	0.02
CD at 5%	0.69	0.81	2.50	8.11	0.07
C_1: Hardwood cutting	9.91	14.86	49.00	235.02	2.01
C_2: Semi hardwood cutting	10.33	15.23	47.67	231.60	1.96
C_3: Softwood cutting	10.62	15.54	46.38	224.16	1.94
SEm ±	0.122	0.143	0.44	1.43	0.01
CD at 5%	0.34	0.40	1.25	4.06	0.04
Interaction (TXC)					
SEm ±	0.421	0.496	1.53	4.98	0.04
CD at 5%	1.19	NS	NS	NS	0.13
CV (%)	7.09	5.64	5.58	3.75	3.92

Table 2: 2 Influence of hormones and cutting types on rooting and biomass of Gliricidia

Hormones treatments (T)	Root length (cm)	Number of primary roots $plant^{-1}$	Fresh weight of root (g) $plant^{-1}$	Fresh weight of shoot (g) $plant^{-1}$	Dry weight of root (g) $plant^{-1}$	Dry weight of shoot (g) $plant^{-1}$
T_1: Control	13.77	2.88	1.26	42.07	0.68	6.49
T_2: IBA 500 ppm	14.21	3.53	1.57	47.79	0.79	9.73
T_3: IBA 1000 ppm	17.90	5.12	2.47	56.78	1.24	11.17
T_4: IBA 1500 ppm	23.13	7.30	3.23	62.48	1.62	15.25
T_5: IBA 2000 ppm	33.52	7.57	3.84	65.03	1.92	17.23
T_6: NAA 500 ppm	14.14	3.35	1.54	43.97	0.77	7.31
T_7: NAA 1000 ppm	17.10	4.73	2.12	51.76	1.08	10.88
T_8: NAA 1500 ppm	19.89	5.89	3.05	59.75	1.54	13.73
T_9: NAA 2000 ppm	22.06	6.47	3.06	61.95	1.57	14.19
T_{10}: IBA 500 ppm + NAA 500 ppm	29.07	6.97	3.65	63.83	1.87	16.27
T_{11}: IBA 750 ppm + NAA 750 ppm	37.15	8.32	4.25	67.00	2.24	17.45
T_{12}: IBA 1000 ppm + NAA 1000 ppm	42.26	9.60	5.63	74.95	2.64	18.21
SEm ±	0.37	0.10	0.06	0.94	0.04	0.20
CD at 5%	1.06	0.30	0.19	2.65	0.13	0.59
C_1: Hardwood cutting	25..52	7.05	3.11	62.06	1.63	14.42
C_2: Semi hardwood cutting	23.99	5.83	3.06	58.17	1.53	13.34
C_3: Softwood cutting	21.54	5.05	2.75	54.11	1.33	11.72
SEm ±	0.18	0.05	0.03	0.47	0.02	0.10
CD at 5%	0.53	0.15	0.09	1.33	0.07	0.29
Interaction (TXC)						
SEm ±	0.65	0.18	0.11	1.63	0.08	0.36
CD at 5%	1.84	NS	NS	NS	NS	NS
CV (%)	4.78	5.43	6.77	4.86	9.52	4.75

Conclusion

As compared to individual and control treatments, IBA 1000 ppm + NAA 1000 ppm was determined to be the most effective treatment for sprouting, roots, growth, and biomass of cuttings of Gliricidia (*G. sepium* Jecq.).

In case of various cutting types hardwood cutting performed better as compare to semi hardwood and softwood cutting for sprouting, rooting, growth and biomass of Gliricidia. It is therefore possible to produce high-quality planting materials for Gliricidia through vegetative propagation through the combination of hardwood cutting with rooting hormones IBA 1000 ppm + NAA 1000 ppm.

References

1. Chauhan KS, Reddy RS. Effect of growth regulators and mist on rooting in stem cutting of plum (*Prunus domestica* L.). Indian Journal of Horticulture. 1971;25:229-231.

2. Ingle MR, Venugopal CK. Effect of different growth regulators on rooting of stevia (*Stevia rebaudiana* Bertoni) cuttings. Karnataka Journal of Agriculture Science. 2009;22(2):460-461.
3. Malakar A, Prakasha DP, Kulapati H, Reddi SG, Gollagi SG, Anand N *et al*. Effect of growing media and plant growth regulators on rooting of different types of stem cuttings in acid-lime Cv. Kagzi. International Journal of Current Microbiology and Applied Sciences. 2019;8(10):2589-2605.
4. Maryam M, Majd A, Jafari S, Kiabi S, Peyvandi M. The effect of various concentrations of IBA and NAA on the rooting of semi hardwood cuttings of Azalea (*Azalea alexander* L.). Advances in Environmental Biology. 2014;8(7):2223-2230.
5. Milind RI. Effect of growth regulators and environments on rooting of stevia cuttings (*Stevia rebaudiana* Bertoni). M.Sc. (Agri.) Thesis, University of Agriculture Sciences, Dharwad; c2008.
6. Patil VN, Chauhan PS, Panchbhai DM, Shivankar RS, Tannirwar AV. Effect of different growth regulators on rooting of hardwood cuttings of some commercial grape varieties. Journal of Soils and Crops. 2000;10(2):295-297.
7. Rao SC, VenkateswarIu B, Babu DM, Wani SP, Dixit S, Sahrawat KL, *et al*. Soil health improvement with Gliricidia green leaf manuring in rainfed agriculture. On farm experiences. Technical Bulletin. 2011;2:1-16.
8. Rathwa AD, Singh V, Patel DD, Patel AH. Influence of propagation media on growth of hardwood and semi-hardwood cuttings of pomegranate cv. Bhagwa. Trends in BioScience. 2017;10(28):023-6027.
9. Ratnamala M. Effect of auxins and type of cutting on propagation of phalsa (*Grewia subinaequalis* dc.) under open and shade net conditions. M.Sc. (Horti.) Thesis, Dr. Y. S. R. Horticultural University, Andhra Pradesh. 2013.
10. Reddy KR, Reddy CP, Goud PV. Effect of auxins on the rooting of Fig (*Ficus carica* L.) hardwood and semi hardwood cuttings. Indian Journal of Agricultural Research. 2008;42(1):75-78.
11. Seiar YA. Effect of growth regulators on rooting of cuttings in pomegranate (*Punica granatum* L.) cv. 'Bhagwa'. Journal of Horticulture Science. 2017;11(2):156-160.
12. Simons AJ, Stewart JL ''Forage tree legumes in tropical agriculture''. Oxford Forestry Institute Department of Plant Science, University of Oxford. CAB International Wallingford UK; c1994. p. 30-48.
13. Singh AK, Bahadur V. Effect of NAA and IBA on rooting and establishment of hard wood cutting in Phalsa (*Grewia subinaequalis* L.). The Allahabad Farmer. 2015;20(2):199-201.
14. Wani SP, Sreedevi TK, Rockstrom J, Ramakrishna YS. Rainied Agriculture - Past trend and future prospectus. [11: Wani SP, Rockstrom J and Oweis T (eds) Rainfed agriculture: Unlocking the Potential. Comprehensive Assessment of Water Management in Agriculture Series. CAB International, Wallingford, UK; c2009. p. 1-35
15. Yusnita, Jamaludin, Agustiansyah, Hapsoro D. A combination of IBA and NAA resulted in better rooting and shoot sprouting than single auxin on Malay apple [*Syzygium malaccense* (L.) Merr. & Perry] stem cuttings. AGRIVITA Journal of Agriculture Science. 2018;40(1):1-9