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COMPARATIVE ANALYSIS ON SEED GROWN AND AIR LAYERED PLANTS OF *ADANSONIA DIGITATA* L

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Abstract: *Adansonia digitata* L. is well known as African baobab. It is native to African subcontinent. Due to anthropogenic activities, the great genetic resources of it, is getting to the verge of extinction. The tree has profound both medicinal and non medicinal uses. It is called 'kalpvriksha' in Hindu mythological literature as all parts are useful. In present investigation a comparative analysis was done for both seed grown and air layered plant under different growth parameters for the first two months. The treatments employed were different in both case. In seed grown plants three treatments along with control were taken. Here T2 showed best result survival percentage 90%; plant mean height (in cm) 19.7(30D), 40.4(60D); branches emergences 4(30D), 10(60D); leaf emergence 10(30D), 11(60D) and highest plant girth (in cm) 2(30D), 2.5(60D). In air layered experiment the best result out of five treatments were seen in T5, survival percentage 100% (DAP), plant mean height (in cm) 28(30D), 56.4 (60D); branches emergence 8(30D), 14(60D); leaf emergence 24(30D), 49(60D) and highest plant girth (in cm) 1.2(30D), 2.1(60D).

INTRODUCTION

Adansonia digitata L. belongs to the family Bombacaceae, an endangered medicinal tree species; mythologically known as 'kalpvriksha'[1]; native to dry regions of tropical Africa, Australia and Madagascar. It is deciduous, 25 meter tall [2,3,4], cylindrical trunk with 28 meter girth covered by 50-100 mm bark layer; [5]identified four growth phases: a) the "sapling phase" that lasts 10 to 15 years, b) the "cone phase" lasts up to 60-70 years, c) the "bottle phase" which ends when the tree is 200-300 years old, d) the "old age phase" that can lead the tree to over 1000 years. Its hollow trunk keeps the water potable for many years and serves as reservoirs during drought. It stores water about 400 gallons in medium sized tree and over 2000 gallons water in large size trees[6]. At early stage, the leaves are simple foliated[7] which later turns into 5-7 finger like clustered palmately compound leaflets. The pendulous, showy white[8] scented flowers with long waxy crinkled petals which surrounds the dense clusters of powder puffs like purple stamens generally blooms at the end of dry season.

The large pendant egg shaped fruit resembles as dead rat hanging by their tails from the tree (10-45 cm long). The outer shell of it is hard, woody and velvet covered; filled with yellowish whitish pulp embedded with dark brown kidney shaped seeds. When fruit get dried the pulp can be powdered which taste acidic[9] due to rich content of ascorbic acid and are used in various foodstuffs. The fruits varied in form like ovoid, spherical, fusiform and elongated[10]. All parts of tree are used in medicine and possess high nutritional value with properties like antioxidant, antipyretic, analgesic, antiviral, antimicrobial, anti-trypanosoma, antidiabetic, diuretic etc. The leaves, bark and fruits are traditionally used as food stuffs and hence baobab is also named "the small pharmacy or chemist tree" [11, 12, 13]. In today scenario, the tree is facing crisis of survival and is enlisted as endangered species in Red data book with only 30 to 40 trees available in India. The natural regeneration is poor due to drought and desertification, animal grazing, uncontrolled bush fires, severe frost [14, 15] kill mature trees and also very hard seed coat check its unaided germination which is usually less than 20%[16]. In nature the seeds were broken through digestive tract of animals and for cultivation by immersing in hot water or by cutting seed coat. The several methods employed in 1988 like wet heat treatment, total or partial seed decoating and scarification with concentrated acids, herbicides, fungicides and growth regulators

and was found that seed treated with herbicides and fungicides failed to germinate[17]. The germination of seeds depends on both depth of planting and soil[18].

The depth of planting influence greatly when moisture, temperature, oxygen and light reaching to seed are considered[19]. The variations may be found due to the germination of seed, size of seed and soil. The seeds grown at shorter depths showed better emergence[20, 21] of seedlings but sometime contradictory too[22].

To break seed dormancy the three pre-treatment techniques (mechanical, thermal and chemical) under three different growth media (potting soil, MS medium and paper boat) were performed to break seed dormancy for *in vitro* germination of African Baobab[23]. The data revealed that seeds pretreated with 98% sulphuric acid, germinated best in paper boat followed by rest treatments.

While in pre sowing treatments, the seed of *Adansonia digitata* showed result such as 73% (80% sulphuric acid), 63% (in hot water treatment), 61% (60% sulphuric acid), 48% (burning under dry grass) and 38% (soaking in tepid water) and 33% (untreated seeds)[24].

In another experiment evident that under three pre- treatment techniques (cold water, hot water and sulphuric acid treatment) of seeds under different growth media (sandy soil, loamy soil and saw dust) , the highest germination rate seen in 98% acid soaked for one hour and then sowed in sandy soil growth medium and was recommended too[25].

On the other hand side, despite of attempting vegetative propagation reported to be failed and planting seed was the only means of propagation. Still many experiments were done to propagate at vegetative level as it not only save time than to growing with seeds but cost efficient and reliable for everyone. It generally consists of stem cutting, air layering and grafting. Vegetative propagation by root cuttings or by grafting or budding can be practiced also [26].

The five replica of stem cutting with nine internodes and eight nodes measuring about 20-25 cm in length were treated with rootex and raw Aloe vera, used for vegetative propagation along with control and set for axillary bud emergence for consecutive from second to fifth weeks in an endangered tree species of Jharkhand [27, 28]. The juvenile stem cutting with double node stem of four months old seedlings treated with IBA and IAA at 0, 50, 200 and 150 mg/L and planted into three different sets of rooting media (top soil, river sand and saw dust) which was replicated three times. The data showed cutting dipped in IBA (150 mg/L) planted in saw dust media (SD/IBA/150mg/L) was assured best for the vegetative propagation [29].

MATERIAL AND METHODS

The seeds of experimental tree (*Adansonia digitata* L.) were collected from trees near to Daltonganj Railway Station, Palamau for *in vivo* seed germination[30]. Here total five seeds used for each treatment (three different growth media- sandy soil, loamy soil and saw dust all mixed with equal amount of vermicompost into 3:1 ratio) and eventually transferred to open field. The parameters set were percentage of seed germination, plant mean height and number of leave emergence for one month duration. For air layering experiment in *Adansonia digitata*, three years old trees grown at village Sudna, district Palamau, Jharkhand[31] was taken. Here for each six different growth media (treatments) were performed in three replicates and studied for pre planting response like rooting success and number of roots/layer for two months [31]. In continuation with of air layering, post planting (day after layering) of it were performed and was further comparatively analyzed from data revealed from *in vivo* seed germination experiment[30]. The growth parameters such as survival percentage, plant mean height, number of branches, number of leaves emergence and highest plant girth were taken into consideration for comparing two different experiments that is seed grown and air layered plants.

Survival percentage of air layers = (Total number of established plants/ Total number of planted layered plants) x 100

RESULT AND DISUSSION

In seed grown plants, different growth media like loamy soil, sandy soil and saw dust were mixed each with one part of vermicompost and third part of soil growth medium. The experiment was under observation for first two months. The best result obtained in (S.S+V) when all growth parameters studied than to (L.S+V), (S.D+V) respectively (Table 1, Plate I, Fig I). The sandy soil mixed with vermicompost promoted well for seedling survivability (90%), plant mean height (19.70cm, 40.40cm) branches (4, 10) and leaves emergence (11, 30) and plant girth (2.0cm, 2.5cm) for both first and second month observation. The similar experiment was also performed on an endangered tree species- *Couroupita guianensis* Aublet[32].

On the other hand, in air layered *Adansonia digitata* plants after pre planting observation[31], was further experimented for post planting response. The treatments were same for each three number of replicates. The treatments were T0 (soil as control), T1 (soil + rootex @0ppm), T2 (soil + vermicompost), T3 (soil + cocopeat), T4 (soil + sand + rootex @300ppm) and T5 (soil + vermicompost + cocopeat). In T0 the survival percentage was 40%, plant mean height (24 cm, 48 cm), branches per layer (0, 1), leaves emergence per layer

(10, 21) and highest plant girth (1.0 cm, 1.3 cm). In T5, T4, T2, T3 in decreasing order resulted in all growth parameters taken for 30 and 60 day after planting (Table 2, Plate I, Fig II). In treatment 5, growth parameters like plant mean height, branches per layer, leaves emergence per layer and girth of plant resulted best of all treatments set. It might be due better response of soil mixed with vermicompost and cocopeat. The formation of roots per layer avails better transportation of food materials and water nutrients from the soil to the plant which resulted to higher survivability and into longer shoots.

The mixture of vermicompost and cocopeat played vital role in maintenance of physical and biological condition of soil and supplied both macro and micronutrients either used individually but more effective in combined state. In air layered acid lime the best rooting media among all was vermicompost mixed with farmyard manure and sand [33]. Apart from these supplements in soil, sand mixed with rootex (@ 300ppm) also resulted better in all growth parameters (Table 2). The similar findings reported by Singh and Pandey (2009)[34], Bisen et al (2010)[35] and Mishra (2014)[36]. It was further stated that rooting media is an integral part for propagation where rooting percentage and the roots qualities are directly influenced by the medium [37]. The response of growth medium to work appropriately depends on the species, cutting type, the season, propagation techniques employed, cost and availability of the medium components [38, 39]. The soil is the base of rooting media [36]. The clonal variation, type of cutting material, different hormonal regimes used and its physical properties of rooting medium can influence rooting, even in more difficult-to-root cultivars [40]. The application of rooting hormones play major role in increasing rooting percentage and plant survivability [41,42,43].

Table 1: Effect of different rooting media on survival and growth attributes on seed grown plant *of Adansonia digitata* L.

S. No	Treatment	Survival %age		Plant mean height (cm)		No. of branches		Leaf emergence		Highest plant girth	
		30 D	60 D	30 D	60 D	30 D	60 D	30 D	60 D	30 D	60 D
1.	T1(L.S + V)	70%	70%	16.2	33.2	0	2	8	20	1.5	1.8
2.	T2(S.S + V)	90%	90%	19.7	40.4	4	10	11	30	2.0	2.5
3.	T3(S.D+ V)	60%	60%	15.1	30.2	0	2	8	25	1.2	1.4

Table 2: Post planting observation of air layered *Adansonia digitata* L. under different rooting media

S. No	Treatment	Survival %age		Plant mean height (cm)		No. of branches		Leaf emergence		Highest plant girth	
		30 DAP	60 DAP	30 DAP	60 DAP	30 DAP	60 DAP	30 DAP	60 DAP	30 DAP	60 DAP
1.	T0	40%	40%	24	48	-----	1	10	21	1.0	1.3
2.	T1	60%	60%	24.5	45	-----	1	12	25	1.1	1.3
3.	T2	80%	80%	25	48	2	3	14	30	1.0	1.5
4	T3	60%	60%	22	45	5	5	12	24	0.9	1.2
5	T4	90%	90%	27	54.3	5	10	18	40	1.0	1.7
6	T5	100%	100%	28	56.4	8	14	24	49	1.2	2.1

Plate I*: In vivo* seed germination of Adansonia digitata L.
Fig 1: Seeds collection for germination.
Fig 2: Seed germination after 10 days of sown.
Fig 3: One month old plant.
Fig 4: 45 days old in vivo plant.

Plate II*:* Air layered plants of Adansonia digitata L.
Fig 1: Plant used for experiment (3 years old tree)
Fig 2: Ring of bark removed from tree branches.
Fig 3: Post planting after root formation
Fig 4: 45 days old air layered plant after post plantation

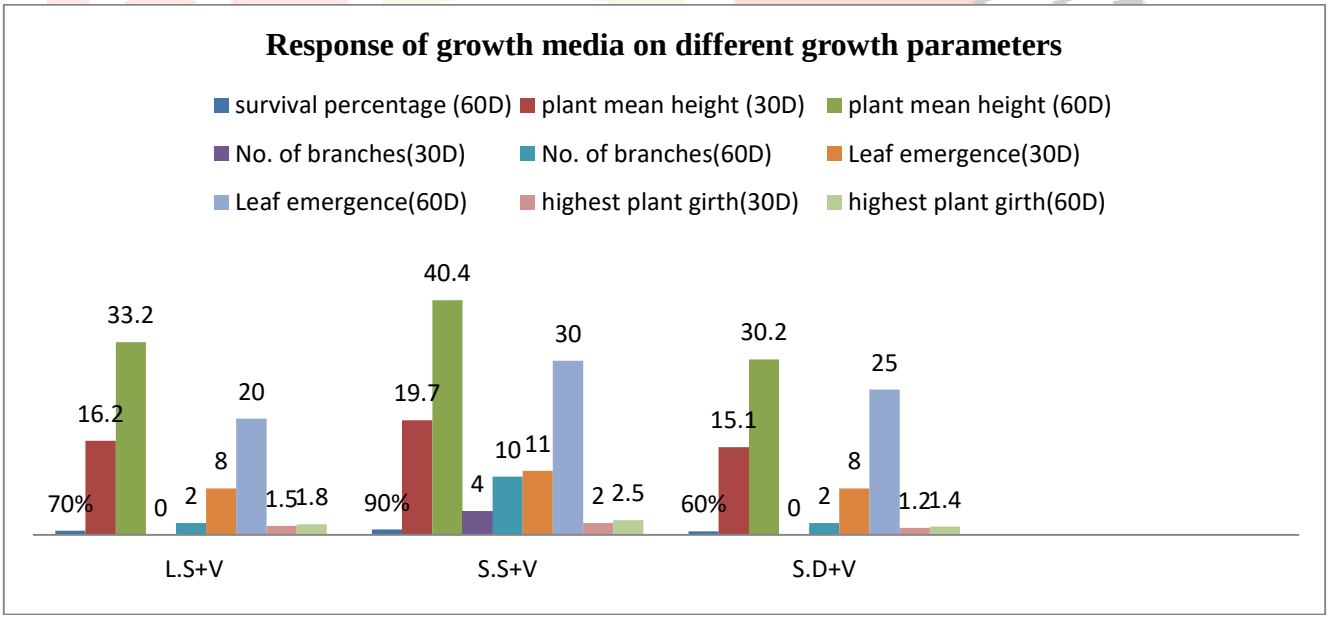
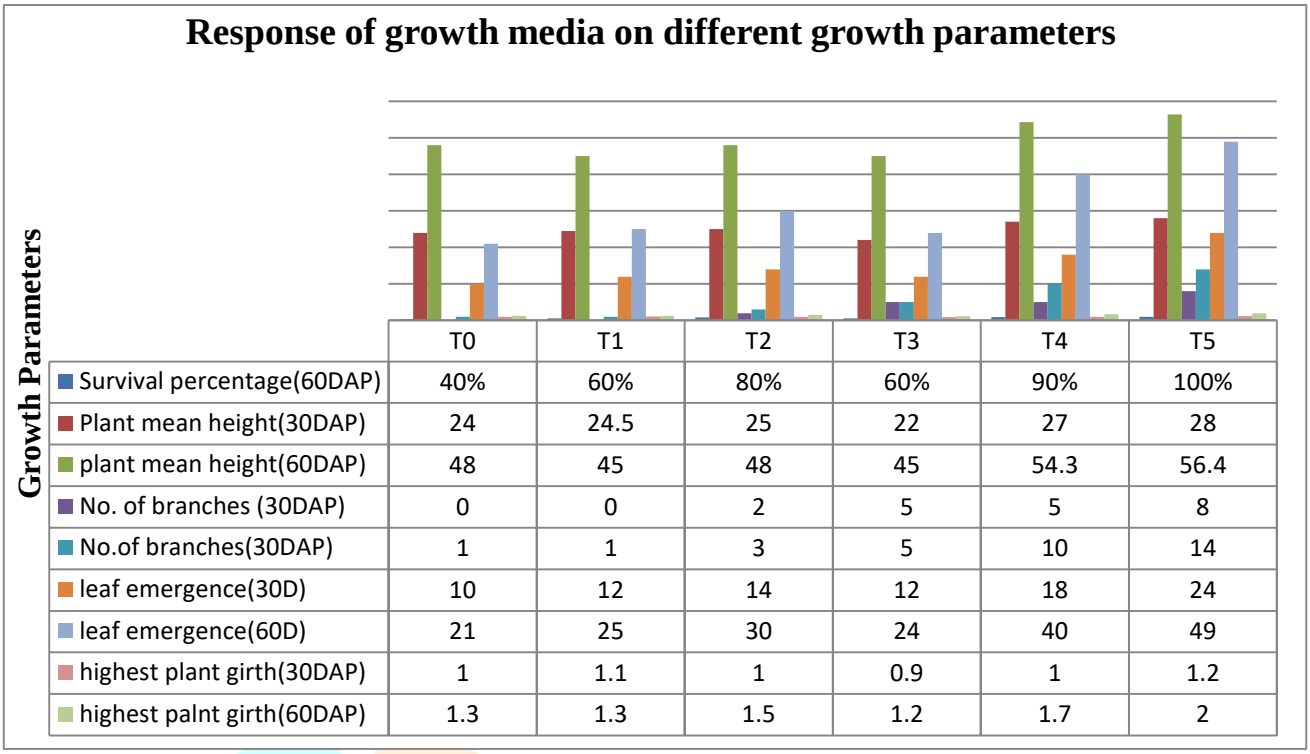


Fig I: Histogram showing response of growth media on different growth media on seed grown plant of *Adansonia digitata* L.



	T0	T1	T2	T3	T4	T5
Survival percentage(60DAP)	40%	60%	80%	60%	90%	100%
Plant mean height(30DAP)	24	24.5	25	22	27	28
plant mean height(60DAP)	48	45	48	45	54.3	56.4
No. of branches (30DAP)	0	0	2	5	5	8
No.of branches(30DAP)	1	1	3	5	10	14
leaf emergence(30D)	10	12	14	12	18	24
leaf emergence(60D)	21	25	30	24	40	49
highest plant girth(30DAP)	1	1.1	1	0.9	1	1.2
highest palnt girth(60DAP)	1.3	1.3	1.5	1.2	1.7	2

Fig II: Histogram showing post planting observation of air layered *Adansonia digitata* L. under different rooting media

CONCLUSION

The different growth media (as treatments) in various combination used in both experiments have their own viable effect on growth and development for different parameters of an endangered plant.

ABBREVIATIONS USED

Cm: centimeter, L.S: Loamy soil, S.D: Sandy soil, S.D: Saw dust, V: Vermicompost, D: Days, DAP: Day after planting, PMH: Plant mean height, HPG: Highest plant growth, (-): No response

REFRENCES

1. Singh S, Parasharmi V, Rai S. Medicinal uses of Adansonia digitata L.: An endangered tree species. Journal of Pharmaceutical and scientific Innovation., 2013; 2(3): 14-16.
2. Sidibe M., and Williams, J.T. (2002). Baobab: Adansonia digitata L. International Centre for Underutilised crops, Southampton, UK, p100
3. Priyadarshi, N, (2008), Baobab (Kalptaru) tree is under threat in Jharkhand state of India, Environment Geology Article.
4. Singh,S.,Rai,S& Khan, S. *In vitro* seed germination of *Adansonia digitata* L.: An endangered medicinal tree. Nanobiotechnica Universities Vol. 1(2), 107-112 (2010)
5. Von Breitenbach F (1985) Aantekeninge oor die groeitempo van aangeplante kremetartbome (*Adansonia digitata*) en opmerkinge ten opsigte van lewenstyd, groeifases en genetiese variasie van die spesie. (Notes on the growth rate of planted baobab trees (*Adansonia digitata*) and observations in respect of lifespan, growth phases and genetic variation of the species). Journal of Dendrology 5(1-2): 1-21.
6. Orwa, C.; Mutua, A.; Kindt, R.; Jamnadass, R.; Anthony, S. (2009). Agroforestree Database: A tree reference and selection guide version 4.0. World Agrofrestry Centre, Kenya
7. Wickens GE (1983): The Baobab: Africa's Upside-Down Tree. Kew Bulletin 37(2): 173-209
8. www.flowerofindia.net
9. Gebaurer, J.,El.K. Siddig and G. Ebert (2002). Baobab (*Adansonia digitata* L.):A review on a multipurpose tree with promising future in the Sudan. Gartenbauwissenschaft, 67(4). S. 155-160.
10. Zoéwindé Henri-Noël Bouda (2014): Adaptive properties of *Adansonia digitata* L. (Baobab) & Parkia biglobosa (Jacq.) R.Br. (African Locust Bean) to drought stress. Department of Geosciences and Natural Resource Management University of Copenhagen.
11. Kerharo, T. and J.G. Adam (1974) “la pharmacopia senegalaise traditionanelle” Plantes medicates et toxiques Editions VigotFrerez, Paris.

12. Etkin, N.L. and P.J. Ross (1982). "Food as medicines and medicines as food" Soc.sci med, 16:1559-1573.
13. Singh, U. and Choudhary, A.K. (2019): *In vitro* seed germination of *Adansonia digitata* L.: An endangered plant species of Jharkhand. Journal of Emerging Technologies and Innovative Research Vol. 6(6) pp.717-722
14. Palmer E, Pitman N (1972) Trees of southern Africa covering all known species in the Republic of South Africa, South-West Africa, Botswana and Swaziland, vol 2, 2nd edition. Bolkema, Amsterdam.
15. Mullin, L.J (1991) The baobab - giant of Zimbabwe's lowveld. Excelsa 15: 63-67.
16. Danthu P., J.Roussel, A. Gaye and E.H El Mazzoudi (1995), Baobab (Adansonia digitata L.) seed pretreatment for germination improvement, Seed Science and Technology, 23(2): 469-475
17. Esenowo, G.J. (1991). Studies on germination of Adansonia digitata seeds. Journal of Agricultural Science, 117 (1):81-8
18. Chia A.M.,D.N lortsuun & B.A. Carthage (2008). *Studies on the Seedling Growth of Adansonia digitata* L. Science World Journal, 3(1):21-24
19. Robert, H.A. & Feast P.M. (1972). Fate of seeds of some annual weeds in different depths of cultivated and undisturbed sol. Weed Research. 12: 316-324
20. Grundy, A. E.; Meand, A. R. & S and, W. 1996. Modeling the effect of weed-seed distribution in the soil profile on seedling emergence. Weed Research, 36:375-376.
21. Abeyo, B. G. 2000. Temperature, planting depth, and genotype effects on seedling characteristics and seeding rate effects on agronomic and quality performance of winter wheat (*Triticum aestivum* L.). Ph.D Thesis, University of Nebraska - Lincoln DAI-B 61/04, 1703.
22. Mc Ginnies, W. J. (1973). Effects of date and depth of planting on the establishment of three range grasses. Agronomy Journal 65:120-123.
23. Shama, N.,Talarai, S., Banala, M., Kagithoju, S. and Nanna, R.S (2017): Effect of pre-treatment on dormancy and in vitro seed germination in globally endangered forest tree Adansonia digitata L. Journal of biotechnology and Biochemistry. Vol. 3(5), pp. 45-52.
24. Oboho, E.G. and Ahanon, E.C. (2017): Effect of different pre-treatment on seed germination and watering regime on growth of Adansonia digitata L. seedling. Asian Journal of Science and Technology. Vol. 08(04) pp. 4569-4573.
25. Falemera, B.C.,Chomini,M.S, Thlama, D.M. & Udenkwere, M.(2014): Pre-germination and dormancy response of Adansonia digitata L. seeds to pretreatment techniques and growth media. European Journal of Agriculture & Forestry Research. 2(1) 31-41.
26. Sidibe, M., Scheuring, J.F., Tembley, D., Sidibe, M.M., Hofmann, P. and Frigg, M. (1996): Baobab-homegrown vitamin C for Africa. Agroforestry Today 8, 13-15
27. Singh, U. (2021): Vegetative propagation of multipurpose tree-*Adansonia digitata* L.:- An endangered tree species of Jharkhand. Int. Journal of Creative Research Thoughts. Vol. 9(11) pp 860-865
28. Singh, U. (2021): Vegetative propagation of Cannonball tree: An endangered tree species of Jharkhand. Int. Journal of Scientific Development and Research. Vol. 6(04) pp 729-735
29. Bunza, M.R., Isah, R.B., and Bello, A.D. (2016): Vegetative propagation of Adansonia digitata L. using juvenile stem cuttings, various rooting media and hormone concentrations. Journal of Research in Forestry, Wildlife and Environment. Vol. 8(4): pp 95-100.
30. Singh, U. (2022): In Vivo Regeneration of African Baobab - An endangered tree species of Jharkhand. Int. Journal for Research Trends and Innovation. Vol. 7(07) pp 1810-1815
31. Singh, U. (2023): Effect of different rooting media in air layered African Baobab (Adansonia digitata L.) - An endangered tree species of Jharkhand. Int. Journal of Scientific Development and Research. Vol. 8(05) pp 2493-2498
32. Singh, U. (2022): Effect of growth media on *in vivo* seed germination of cannonball tree (*Couroupita guianensis* Aubl.): An endangered tree species of Jharkhand. Int. Journal of Creative Research Thoughts. Vol. 10(04) pp 421-426
33. Verma, B., and Sahu, G.D. (2022). Studies on the effect of different rooting media on survival and success of air layering in acid lime (Citrus aurantifolia Swingle) under Chattisgarh plain. The pharma Innovation Journal. 11(12): 225-228.
34. Singh, B.V. and Pandey, S.K. (2009) Influence of growth regulators and rooting medium on promotion of root characters and survival of air- layered guava shoots. Annals of plant and Soil Research, 11(2): 120-121
35. Bisen, A., Pandey, S.K. and Mishra, S.P. (2010) Efficacy of bio-regulators and rooting media on rooting and survival of air layers of guava. Annals of Plant and Soil Research, 12(2): 115-118.

36. Mishra, S. (2014): Effect of different rooting media on survival and success of air layers in Kagzilime. Annals of Plant and Soil Research 16(3): 264-267
37. Loach (1988) Controlling environment condition to improve adventitious rooting. In: Adventitious root formation in cuttings (Davis, T.D., Haissig, B.E. and Sankhla, N., eds.). Dioscorides Press, Portland, Oregon, pp. 248-279.
38. Hartmann, H.T., Kester, D.E., Davies, F.T., Geneve, R.L. Jr. (2002) Plant Propagation Principles and Practices. 7th ed. Prentice Hall, NJ, pp. 880.
39. Fabbri, A., Bartolini, G., Lambardi, M., Kailis, S. (2004) Olive Propagation Manual, Landlinks Press, Collingwood, pp. 141
40. Infendiyaroghu, M., Ozeker, E. and Baser, S. (2009) Rooting of "Ayvalik" olive cutting in different media. Spanish Journal of Agricultural Research, 7(1): 168-172.
41. Dubey S, Sahu GD, Hota D, Lanjhiyana R, Chandrakar K. (2022): Impact on biometric response of papaya as influenced by phyto bioregulator. The Pharma Innovation Journal. 11(2): 1031-1035
42. Dubey S, Sahu GD, Hota D, Kumar V.(2020): Deciphering the consequences of phyto bioregulators on physical parameters of papaya (Carica papaya) cv. Red Lady. Journal of Pharmacognosy and Phytochemistry. 9(4): 638-640
43. Hota D, Sharma DP, Bhoyar MG.(2017) Analysis of vegetative growth by spraying of forchlorofenuron and N-acetyl thiazolidine 4-carboxylic acid on of apricot (Prunus armenicana L.) cv. New Castle. International Journal of Chemical Studies. 5(5): 2182-2185