International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Selection of Suitable Biofertilizers for Production of Quality Planting Stock of *Adansonia Digitata*

Archana Sharma[1], Pradeep Vasudeva[2]

[1]Scientist - E, MP State Forest Research Institute, Jabalpur, Madhya Pradesh, India
Email: *archanasfri[at]gmail.com*

[2]PCCF & Director, MP State Forest Research Institute, Jabalpur, Madhya Pradesh, India
Email: *pvasudev1967[at]gmail.com*

Abstract: ***Adansonia digitata L. (family Malwaceae) is commonly known as baobab tree is, native to Africa and is widely used for agro forestry, construction, and aesthetics. The study evaluates the effects of different biofertilizers on growth and biomass of A. digitata seedlings in a nursery. Various combinations of biofertilizers were tested, and the results indicate that PSB and Rhizobium treatments significantly enhanced seedling height, biomass and survival compare to the control. The maximum seedling length of 238 cm and biomass of 250.17 gm were recorded with PSB treatment, with a survival rate of 100%. The results indicate that biofertilizers play a significant and complex role in plant growth and survival of Adansonia digitata.***

Keywords: Seedling growth, biomass, plant survival, biofertilizers.

1. Introduction

Adansonia digitata is a highly exploited economic tree with a wide spectrum of its importance. It is commonly known as Khurasani Imli and belongs to family Malwaceae.

It is a exotic species and it is most wide spread on the Africa continent, found in the hot, dry savannahs of the sub Saharan Africa (Sundarmbal M, et. al., 2015). It is a large, round canopied tree with a swollen trunk. The tree flowers from October to December and fruits ripen from May - June. The tree has great potential for agro forestry serving as wind break, fodder for animals, food and aesthetics etc. The wood is used for making canoes, rafts, insulating boards, boxes and floats for fishing nets. The increase in the demand of major part of the plant by man has encouraged the cultivation of *Adansonia digitata* in homes, gardens, estates and large parks. Therefore, its presence could be said to be indicative of human happitation because only very few are still found growing in the wild. Despite the immense importance of this plant, it is necessary to produce quality planting stock for future plantation programme. The present study was undertaken to produce quality plants and higher survival of its plants through develop best technology i. e. best potting media. The study aims to identify the most effective biofertilizers for enhancing the growth and biomass of *Adansonia digitata* seedlings to improve their survival rate and quality in nursery condition.

2. Materials and Methods

In the study was conducted the green net house of the State Forest Research Institute, Jabalpur (MP). Six months old seedlings of *Adansonia digitata* were taken for study and the potting mixture comprised of soil, sand, vermicompost with different ratio and soil, sand, FYM alone and with different dosage of Azotobacter, PSB, Rhizobium and neem cake. The potting mixture was analyzed for its physico - chemical properties prior to experimental use. Total 28 treatments were tried using various combinations of bio - fertilizers. Details as under:

T. No.	Treatments Name	T. No.	Treatment Name
T0	Control (only Soil)	T15	T0 + 100gm Azotobacter
T1	Soil + Sand + FYM (1: 1: 1)	T16	T0 + 2Ogm PSB
T2	Soil + Sand + FYM (2: 1: 1)	T17	T0 + 4Ogm PSB
T3	Soil + Sand + FYM (1: 2: 1)	T18	T0 + 6Ogm PSB
T4	Soil + Sand + FYM (1: 1: 2)	T19	T0 + 8Ogm PSB
T5	Soil + Sand + FYM (2: 2: 1)	T20	T0 + 1OOgm PSB
T6	Soil + Sand + Vermi (1: 1: 1)	T21	T0 + 2Ogm Rhizobium
T7	Soil + Sand + Vermi (2: 1: 1)	T22	T0 + 4Ogm Rhizobium
T8	Soil + Sand + Vermi (1: 2: 1)	T23	T0 + 6Ogm Rhizobium
T9	Soil + Sand + Vermi (1: 1: 2)	T24	T0 + 8Ogm Rhizobium
T10	Soil + Sand + Vermi (2: 2: 1)	T25	T0 + 1OOgm Rhizobium
T11	T0 + 20gm Azotobacter	T26	T0 + 2Ogm Neem cake
T12	T0 + 40gm Azotobacter	T27	T0 + 5Ogm Neem cake
T13	T0 + 60gm Azotobacter	T28	T0 + 1OOgm Neem cake
T14	T0 + 80gm Azotobacter		

Experimental Design

Experimental design was RBD (Random Block Design).03 replicates with each of 15 seedlings were taken for each treatment. Total 435 seedlings were taken for this study. Different dosage of bio - fertilizers was applied at the time of transplantation of seedlings from nursery bed to poly pots. Normal watering was done after application. After one year of the experiment following observations were recorded to assess the response of seedling with various potting mixture.

3. Observations

1) Growth performance (root shoot length).
2) Survival percentage of seedlings.
3) Seedling biomass in terms of root and shoot biomass (dry biomass).
4) Growth increment against control.

Measurement of Seedling Growth and Biomass

Random 09 plants from each treatment (03 from each replicate) were taken for measuring growth performance.

The length of seedling was measured by scale. The dry biomass was estimated after keeping plant material in oven at 70°C for 03 days or till constant weight.

Table 1: Effect of various potting mixture on seedling growth, biomass and survival of *Adansonia digitata* under nursery stage in poly - pots.

TN	Treatment	Before Treatment			After Treatment			Growth Increment	Growth Increment against control	Biomass (g/Plant)	Survival %
		RL	SL	TSL	RL	SL	TSL				
T0	Control (only Soil)	17.00	20.00	37.00	34.00	86.00	120.00	224.32	0.0	100.60	55.50
T1	Soil + Sand + FYM (1: 1: 1)	16.00	21.00	37.00	36.00	92.00	128.00	245.95	106.67	129.50	66.67
T2	Soil + Sand + FYM (2: 1: 1)	17.00	22.00	39.00	40.00	117.00	157.00	302.56	130.83	152.70	66.67
T3	Soil + Sand + FYM (1: 2: 1)	17.50	22.00	39.50	37.00	101.00	138.00	249.37	115.00	149.40	55.50
T4	Soil + Sand + FYM (1: 1: 2)	18.00	21.00	39.00	38.00	122.00	160.00	310.26	133.33	137.10	78.00
T5	Soil + Sand + FYM (2: 2: 1)	18.00	21.00	39.00	33.00	105.00	138.00	253.85	115.00	110.50	78.00
T6	Soil + Sand + Vermi (1: 1: 1)	18.00	21.00	39.00	39.00	128.00	167.00	328.21	139.17	143.70	89.00
T7	Soil + Sand + Vermi (2: 1: 1)	17.00	21.00	38.00	35.00	114.00	149.00	292.11	124.17	144.80	89.00
T8	Soil + Sand + Vermi (1: 2: 1)	18.00	24.00	42.00	36.00	146.00	182.00	333.33	151.67	180.64	89.00
T9	Soil + Sand + Vermi (1: 1: 2)	19.00	22.50	41.50	41.00	107.00	148.00	256.63	123.33	143.60	100.00
T10	Soil + Sand + Vermi (2: 2: 1)	17.00	21.50	38.50	36.00	103.00	139.00	261.04	115.83	66.50	89.00
T11	T0 + 20gm Azotobacter	14.50	21.50	36.00	36.00	110.00	146.00	305.56	121.67	132.10	89.00
T12	T0 + 40gm Azotobacter	17.50	20.00	37.50	31.00	103.00	134.00	257.33	111.67	155.90	78.00
T13	T0 + 60gm Azotobacter	16.00	20.00	36.00	48.00	101.00	149.00	313.89	124.17	162.90	89.00
T14	T0 + 80gm Azotobacter	17.00	20.00	37.00	48.00	126.00	174.00	370.27	145.00	169.20	89.00
T15	T0 + 100gm Azotobacter	18.00	21.00	39.00	49.00	144.00	193.00	394.87	160.83	195.30	100.00
T16	T0 + 2Ogm PSB	16.00	21.00	37.00	39.00	156.00	195.00	427.03	162.50	199.80	89.00
T17	T0 + 4Ogm PSB	17.00	21.00	38.00	58.00	180.00	238.00	526.32	198.33	250.17	100.00
T18	T0 + 6Ogm PSB	16.60	21.50	38.10	35.00	138.00	173.00	354.07	144.17	174.46	89.00
T19	T0 + 8Ogm PSB	17.00	21.50	38.50	52.00	159.00	211.00	448.05	175.83	217.20	100.00
T20	T0 + 1OOgm PSB	16.00	19.50	35.50	36.00	104.00	140.00	294.37	116.67	164.20	78.00
T21	T0 + 2Ogm Rhizobium	17.00	19.00	36.00	41.00	100.00	141.00	291.67	117.50	187.30	78.00
T22	T0 + 4Ogm Rhizobium	17.00	21.00	38.00	56.00	168.00	224.00	489.47	186.67	234.49	100.00
T23	T0 + 6Ogm Rhizobium	16.00	20.00	36.00	48.00	126.00	174.00	383.33	145.00	160.90	89.00
T24	T0 + 8Ogm Rhizobium	17.00	20.00	37.00	34.00	130.00	164.00	343.24	136.67	123.90	78.00
T25	T0 + 1OOgm Rhizobium	16.00	19.00	35.00	34.00	106.00	140.00	300.00	116.67	117.00	66.67
T26	T0 + 2Ogm Neem cake	17.00	20.00	37.00	32.00	148.00	180.00	386.49	150.00	174.00	78.00
T27	T0 + 5Ogm Neem cake	16.00	20.00	36.00	52.00	117.00	169.00	369.44	140.83	164.10	78.00
T28	T0 + 1OOgm Neem cake	17.00	21.50	38.50	36.00	129.00	165.00	328.57	137.50	171.10	66.67

RL - Root Length, SL - Shoot Length, TSL - Total Seedling Length.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
TSL	Between Groups	68562.621	28	2448.665	214.536	.000
	Within Groups	662.000	58	11.414		
	Total	69224.621	86			
Biomass	Between Groups	127915.602	28	4568.414	7583.038	.000
	Within Groups	34.942	58	.602		
	Total	127950.544	86			

4. Results

The findings of present study showed that effect of bio - fertilizers such as PSB and Rhizobium on growth and development of *Adansonia digitata* seedlings was found considerably maximum as compare to control and other treatments with respect to seedling growth, seedling biomass and survival of plants. Table - 1 shows the growth performance of *Adansonia digitata* seedlings in different treatment under various combinations of biofertilizers, vermicompost and neem cake. The data revealed that after experiment, in control the total length of seedlings was found to be 120.0 cm. However, under different treatments and different combination of biofertilizers, the doses of Soil + 40gm PSB (T17) per plant gave promising in terms of growth performance viz. seedling length, seedling biomass in terms of root and shoot biomass and growth increment. The maximum length of seedling 238.0cm was recorded with treatment T17 (Soil + 40gm PSB), followed by 224.0 cm with treatment T22 (T0+ 40gm Rhizobium) and 211.0cm seedling length with treatment T19 (T0 + 8Ogm PSB). The observations were also recorded on seedling biomass and growth increment. The maximum biomass 250.17 gm/seedlings was found to be with treatment T17 followed by 234.49 gm/seedling with treatment T22 and 217.20 gm/seedling with T19 against 100.60 gm/seedling in control. Similarly, the highest growth increment 526.32 and survival 100% was also recorded with treatment T17 against 55.50% survival in control.

5. Discussion & Conclusion

The growth of seedlings in nursery stage also depends upon the tree species type and growth characteristics. Moreover,

current findings are in line with the findings of earlier researchers on various tree species as well as exotic species. Normally certain bio - fertilizers enhance the growth of seedlings due to their symbiotic and positive interaction with the seedlings (Duponnoisa *et. al.*2005, Wu. *et. al.*2010). Among different microbes, plant growth promoting microbes like VAM fungi, Azotobacter, Phosphobacteria, and Rhizosphere are able to exert a beneficial effect upon plant growth. Furthermore, the increase in seedling biomass production may be strongly co - related with improve accumulation of N due to Azotobacter and P due to PSB inoculation (Ratha Krishnan et. al., 2004). These microbes have multiple functions in nitrogen fixation, phosphorus solubilization and mobilization (Sen and Paul, 1957) and stimulating root development by producing metabolites like IAA and other growth hormones (Lynch, 1990). Normally effect of plant growth promoting microbes on the growth performance varied with the treatments and the host plant species (Sreedhar and Mohan, 2016). The study highlights the significant role of biofertilizers, particularly PSB and Rhizobium, in enhancing the growth, biomass and survival of *Adansonia digitata* seedling. The use of biofertilizers in nursery conditions can improve seedling quality, contributing to successful plantation efforts for this economically and ecologically important species.

References

[1] Duponnoisa RA, Colombeta VH and Thioulousec J. "The mycorrhizal fungus Glomus intraradices and rock phosphate amendment influence plant growth and microbial activity in the rhizosphere of Acacia holosericea", Soil Biology and Biochemistry 37: 1460 - 1468, 2005.
[2] Lynch JM, Microbial metabolites. In: Lynch JM (eds). The Rhizosphere, Wiley, Chichester, pp.177 - 206, 1990.
[3] Ratha Krishnan P, Rajapandian JS and Kalaiselvi T. "Influence of inoculation of biofertilizers on growth and biomass productivity of Simarouba glauca seedlings", My Forest 40 (2): 197 - 202, 2004.
[4] Sen A and Paul NB. "Solubilization of phosphate by some common soil bacteria", Current Science 26: 222, 1957.
[5] Sreedhar SS and Mohan V. "Effect of arbuscular mycorrhizal (AM) fungi and plant growth promoting rhizobacteria (PGPR) as bio - fertilizers on growth enhancement of economically important native tree species", Neolamarckia cadamba seedlings. Kavaka 47: 125 - 133, 2016.
[6] Sundarambal M, Muthusamy P. Radha R., Zerad Suresh A. "A review on Adansonia digitata Linn", Journal of Phamacognosy and phytochemistry, 4 (4): 12 - 16, 2015.
[7] Wu QS, Zou YN and XH H. "Exogenous putrescine, not spermine or spermidine, enhances root mycorrhizal development and plant growth of Trifoliate orange (Poncirus trifoliate) seedlings", International Journal of Agriculture and Biology 12: 576 - 580, 2010.

Author Profile

Dr. Archana Sharma is working as Head of Forest Productivity Division in M. P. State Forest Research Institute, Jabalpur. She was awarded in Ph. D. degree in Seed Science in 1993 from Dr. H. S. Gaur University, Sagar, (Madhya Pradesh, India). She has credit more than 80 research paper published in both National and International journals and three bulletins and fourteen brochures. She has 30 years of research experience in seed technology. She has completed more than 35 externally funded research projects in the capacity of Principal Investigator. She has organized a number of trainings and workshops at National and State levels. She has imparted trainings to field foresters, University scholars, NGOs and Rural Communities engaged in seed technology, sustainable management and harvesting of bio resources.
Dr. Archana Sharma, Scientist - E and Division Head, State Forest Research Institute, Jabalpur (Madhya Pradesh), India
archanasfri[at]gmail.com

Pradeep Vasudeva is a member of the 1992 batch of the Indian Forests Service and is borne on Madhaya Pradesh Cadre. At present he is posted as Principal Chief Conservator of Forests and Director of MP State Forest Research Institute, Jabalpur. He holds degrees in Mathamatics, Business Management and English literature. He has written two novels Encounters: Fair and Foul, The Realm of Beauty and many short stories. He has 30 years experience in forestry sector. He has organized a number of trainings and workshop at National and State level.
Pradeep Vasudeva, PCCF & Director, State Forest Research Institute, Jabalpur (Madhya Pradesh), India
pvasudev1967[at]gmail.com