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Quality seedling production as influence by various nutrient source: A review

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Abstract

Soil nutrient management is necessary to maintain the constant productivity of nursery systems as well as good quality soil. Organic manure increased soil pH, the concentrations of nitrogen, phosphorus, and major cations. Nutrients available for plant uptake rise significantly in the experimental soil by organic manure application. Biofertilizers during the initial stage of growth, increases seedling vigour and enhance growth by improving root activity and robustness of seedling for proper field establishment. Inorganic fertilizers have a high nutrient content and require only a minimal amount for growth and biomass. Integrated Nutrient Management (INM) implies the most efficient use and management of organic, inorganic and biological sources of major nutrients as well as micronutrients to attain higher levels of seedling growth.

Keywords: INM, organic manure, bio-fertilizers, inorganic fertilizer

1. Introduction

Forests, the key element of the terrestrial ecosystem are crucial for the wellbeing of humanity. They provide foundations for life on earth through ecological functions, by regulating climate and water resources and by serving as habitats for plants and animals. They also furnish a wide range of essential goods such as food, fodder, fuel and medicines, in addition to opportunities for recreation, spiritual renewal and other services. However, in the recent past, this natural resource has been subjected to various pressures mainly biotic and abiotic pressures. According to the national forest policy, 1988, the area under forest/tree cover should be enhanced to 33% of the total land area. This can be achieved by rehabilitating the degraded forests and by promoting the plantation forestry. Plantation forestry was initiated mainly for the production of industrial raw materials as well as fuel wood and fodder. Now days for afforestation and plantation, quality seedling is much needed. Biomanures and biofertilizers have been widely used in forest nurseries to produce high-quality planting stock in recent years. For afforestation and recovery of degraded lands, mining overburdens, and other challenging regions, biofertilizers are quite effective. Biofertilizers are biologically active products or microbial inoculants of bacteria, algae, and fungus that can aid biological nitrogen fixation, phosphate solubilization, and mobilisation, as well as help plants live in wastelands and other difficult soils. Organic fertilisers (biomanures) are also included in these biofertilizers, which are rendered available through the interaction of microorganisms or their relationship with plants. Organic manure plays a critical role in enhancing soil media by altering the pore size distribution and, as a result, the majority of soil physical properties, such as bulk density, moisture constants, hydraulic conductivity, water consumption, and water usage efficiency. Integrated nutrient management is a relatively new method in agriculture, where maintaining a high level of biomass output has become a critical national need. INM considers how to improve the performance of soil by enhancing its chemical and biological qualities. As a result, adopting INM practice in the field of forestry has a great chance of producing high-quality seedlings. The study show improvement in seedling quality, thereby stand establishment with use of organic manure, biofertilizer and chemical fertilizer. This review collect the study which show seedling growth, biomass and quality as influence by different source of nutrient.

1. Organic manure

Manures are organic compounds generated from animal, human, and plant waste that include complex organic forms of plant nutrients. Manure contains huge amounts of organic carbon and nutrients, which promote the growth, abundance, and diversity of microbes in the soil by stimulating enzyme-mediated microbial activity. Increases in soil microbial content, in turn, will have an impact on soil-plant interactions, either directly by boosting nutrient availability or indirectly by changing soil characteristics.

Impact of organic manure

In neem seedlings, Biradar *et al.* (2001) [5] discovered that using vermicompost alone resulted in a greater germination rate (80.7) than using any other potting mixture. In addition, the vermicompost treatment resulted in increased shoot growth and leaf area.

Vijayanathan *et al.* (2005) [31] stated that in *Pongamia pinnata* seedlings, a treatment of vermicompost at 100 g/seedling resulted in greater shoot length (42.6 cm), root length (51.50 cm), collar diameter (0.77 cm), and dry weight (18.13 g) than control.

Raman *et al.* (2008) [23] stated that the seeds treated with

FYM alone produced the most seedlings. The results also demonstrated that adding chemical fertilizer to *Dalbergia sissoo* Roxb. at the nursery stage resulted in a significant difference in growth between the FYM and fertilizer treatments.

Devaranavadgi *et al.* (2010) [7] investigate the effect of nursery mixtures on nutrient content and quality characteristics of seedlings of various tree species and it was discovered that different nursery combinations had a substantial impact on the nitrogen and potassium content of seedlings of various tree species. The seedling quality and seedling vigor index of Teak seedlings were noted maximum in black soil: vermicompost: black sand (2:1:1) while shoot: root ratio in red soil: FYM: white sand (2:1:1) at all growth stages.

Uddin *et al.* (2012) [30] performed an experiment to understand the seedling growth and nodulation capabilities of five major leguminous tree species (*Acacia mangium, Acacia hybrid, Acacia auriculiformis*, *Albizzia lebbeck* and *Leucaena leucocephala*) in response to application of organic fertilizers. They discovered a link between seedling development and various dosages of organic fertiliser. Treatment with a higher concentration of organic manure resulted in much faster seedling growth. In comparison to the control condition, organic fertiliser increased the quantity and size of nodules.

Atik *et al.* (2015) [3] conducted an experiment to see the effect of vermicompost, on the root collar diameter and height growth of seedlings of Black pine with three different concentrations of vermicompost solution. Result revealed that mean root collar diameter was 21.5% more in seedlings of VT_1 (Vermicompost of 1:1000), 22.9% more in VT_2 (Vermicompost of 1:500) and 24.1% more in VT_3 (Vermicompost of 1:100) treatment. While the seedling height and growth were 17.6% more in VT_1 treatment, 19.2% more in VT_2 and 19.5% more in VT_3 treatment.

Lamani *et al.* (2016) [15] found growth parameters found higher in the treatment of elevated CO_2 with 15 kg FYM such as seedling height (26.32 cm) and leaf area per plant (247.84 cm^2) as compared to the other treatments.

Manikantha *et al.* (2016) [18] investigated the effect of *in-situ* moisture conservation measures and organic manures application on growth of *Simarouba glauca* seedlings. They recorded maximum plant height (1.71 m), collar diameter (3.49 cm), crown diameter (126.89 cm) and number of leaves (60.66) in vermicompost treatment as compared to control.

2. Biofertilizer

Biofertilizers are defined as preparations containing living cells or latent cells of efficient strains of microorganisms that help crop plants' uptake of nutrients by their interactions in the rhizosphere when applied through seed or soil.

Influence of biofertilizer

Anand (2011) [2] found that an application of combine inoculants i.e, *Azatobactor* + *Azospirillum* + P-solubalizer (10 g each/seedling) significantly increased the seedling growth attributes of *Melia dubia viz*., plant height (112.51 cm), collar diameter (6.77 mm), number of leaves (361.37), total fresh weight (0.146 g) and dry weight (0.66 g) and root: shoot ratio (1.15) as compared to single inoculants treatment.

El-Dengawy *et al.* (2011) [8] conducted an experiment to examine if *Azospirillum* inoculation could improve the growth and salinity tolerance of carob seedlings (*Ceratonia siliqua* L.) and found that the growth of carob seedlings in salinity-affected locations may be significantly improved. Seedling morphological features improved as a result, particularly the area of new leaves, dry weight, and root surface. Inoculation also improved physiological characteristics such as leaf mineral concentration, chlorophyll, and total phenols concentrations.

Dash *et al.* (2013) [6] concluded that *Dalbergia sissoo* seedling inoculated with different strain of bacteria and fungi increased the plant growth. Better growth and biomass were noted in seedling inoculated with *Aspergillus sp.* and *P. chrysogenum*.

El-Quesni *et al.* (2013) [9] concluded that using bio-fertilizers such as algae, microbien, and phosphorene in agricultural treatments was a safe way to avoid the negative effects of mineral fertilisers, as well as having a positive impact on growth and chemical composition of *Jatropha curcus* L. seedlings.

Revathi *et al.* (2013) [24] conducted an experiment on integrated nutrient management on growth enhancement of *Dalbergia sissoo* Roxb. Seedlings and suggested that dual inoculation with bio-fertilizers (*Rhizobium* and AM) was impressive in improving the growth and biomass of shisham under normal soil whereas in alkaline soil, blending of micronutrients with bio-fertilizers (*Rhizobium* + AM) had better growth and biomass.

Mohan and Rajendra (2014) [20] studied the effect of inoculation of Azospirillum *(Azospirillum brasilense*), AM fungi (*Glomus fasciculatum*) and Pseudomonas (*Pseudomonas flurorescens*) on shoot length, root length, collar diameter and biomass of Feronia seedling. They found that the combined inoculation of *Azospirillum* + AM fungi + Pseudomonas increased shoot length, root length, collar diameter and biomass about 77.47%. They also reported that combined inoculation of bio-inoculants was beneficial for increasing growth, biomass and good quality seedling production.

Al-Hadethi *et al.* (2017) [1] studied the effect of some microbial inoculants on 1 year's old trees of "Peento" Peach cultivar. They found maximum leaf area, leaf chlorophyll content, stem diameter and branch length in treatment (T_8) *Azotobacter chroococcum* + *Azospirillum brasilense* + *Bacillus megatherium*.

Maharana *et al.* (2018) [17] conducted an experiment to assess the growth performance of the Sivan (*Gmelina arborea* Roxb.) seedlings in response to various bio-fertilizers application such as AM, PSB, *Azospirillum* and Banana Pseudostem Sap (Novel) in sole and combinations along with control. The results revealed that bio-fertilizers application significantly influence the growth parameters, total biomass and quality of seedlings. Among all treatments, bio-fertilizers combination AM + PSB + Banana Pseudostem Sap reflected maximum seedling height (156.52 cm), collar diameter (13.20 mm), number of leaves per plant (24.67), leaf area per plant (3708.93 cm^2), root length (30 cm) and number of roots per plant (21.67), fresh and dry biomass of leaves, shoot and whole plant.

3. Inorganic fertilizer

Inorganic fertilizers are water soluble, they are ideal for quick plant growth. As a result, the effect is usually rapid and fast, and it contains all vital nutrients that are ready to use. Inorganic fertilizers have a high nutrient content and require only a minimal amount for growth and yield. Correctly applied inorganic fertilizer can improve soil organic matter by increasing root mass and crop residues.

Effect of Inorganic fertilizer

Bhuiyan *et al.* (2000) [4] tested the effects of three inorganic fertilizers on *Casuarina equisetifolia* seedlings: urea, triple super phosphate, and murate of potassium. In comparison to the control, seedlings treated with 0.64 g of urea, 0.63 g triple super phosphate, and 0.76 g of muriate of potash generated the best quality seedlings.

Kannur and Devar (2003) [11] observed that 1 g N per seedling had significant effect on all growth parameters of Teak seedling by producing maximum height (63.5 cm), collar diameter (1.16 cm), number of leaves (9.25), leaf area (354.8 cm^2) and root length (39.6 cm) which was raised by stumps. Very poor performance of all growth parameters was observed in the treatment with 5 g N per seedling.

Tiwari and Saxena (2003) [29] recorded highest height of *Dalbergia sissoo* seedling at six months when 100 mg urea and 50 mg single super phosphate were applied.

Kumar and Siddiqui (2004) [14] performed an experiment to assess the effect of different doses of fertilizers on *Terminalia arjuna* seedlings. They observed that among different doses of applied urea, the treatments which having 100 mg and 150 mg were found to be highly significant. The leaf area, root length and dry weight were recorded maximum in treatment in which 100 mg of urea was applied.

Kumar (2006) [13] tested the effect of different phosphorus dosages on the growth of *Populus deltoides* seedlings in a nursery setting. The results demonstrate that applying P_2O_5 at rates of 100 kg per ha and higher resulted in enhanced plant height over the control.

According to Thriveni *et al.* (2010) [28], strong seedlings of *Nothapodytes nimmoniana* may be cultivated economically by applying complex fertilisers at a rate of 0.25 g per plant on a monthly basis. When compared to other treatments, it resulted in a considerable increase in seedling growth and dry biomass.

Lebba (2011) [16] found that an application of complex fertilizers at 1.0 g/seedling in *Melia dubia* seedlings enhanced the seedling growth attributes *viz*., seedling height (108.9 cm), number of leaves (21.06), collar diameter (6.66 mm), root length (31.72 cm), total fresh weight (78.40 g) and dry weight (17.60 g) as compared to control.

4. Combined application of organic manure, biofertilizer and chemical fertilizer (INM)

Mishra and Channabasappa (2013) [19] reported that treatments of integrated combination of FYM + NPK + PSB (1 Kg/plant + 50% of RDF + 100 g/plant) showed best performance among all the treatments with highest plant height, collar diameter, number of leaves and leaf area per plant i.e. 127.79 cm, 24.13 mm, 18.13 and 422.53 cm^2, respectively at the end of 8 MAT; which showed an increase of 259.90% (plant height), 215.00% (collar diameter), 97.06% (number of leaves) and 74.79% (leaf area per plant) over initial readings in teak seedling.

Sumbli and Koppad (2013) [26] studied the effect of in-situ moisture conservation structures and application of manures and fertilizers on growth of *Acacia auriculiformis* in Hegdekatta Watershed area of Uttar Kannada district. They observed maximum plant height, DBH, volume, CAI and MAI with application of FYM along with RDF in *Acacia auriculiformis*.

Haggag *et al.* (2014) [10] observed highest increment in plant height and lateral shoot number/ seedling with an application of bio-fertilizers without chemical fertilizer (NPK) in Olive seedling. They also found maximum number of leaves, dry weight of leaves, N and K content in treatment of 100% NPK and 2.5 g Nitrobein.

Shetta *et al.* (2014) [25] conducted an experiment on influences of mineral fertilization with NPK, inoculation and methods of inoculation on seedling growth of two woody legume trees and revealed that seedlings of Willow wattle (*Acacia saligna*) and Leucaena (L. *leucocephala*) were significantly affected by inoculation with *Rhizobium* in combination with mineral fertilizers on the growth and nodulation of seedlings. The soil inoculation was better than seed inoculation in *Leucaena leucocephala* with more responded to inoculate with *Rhizobium* strains in presence of mineral fertilizer treatments as compared to Willow wattle (*Acacia saligna*).

Khamis *et al.* (2015) conducted an experiment to examine the effects of mineral nitrogen (N) and phosphorus (P) and their combination (N+P) as well as bio-fertilizers namely phosphorene and nitrobin on vegetative growth, biomasses, content and uptake of N, P and K in leaves of *Melia azedarach* and *Populus euphratica* seedlings. They revealed that height, stem diameter, leaves fresh weight, leaves dry weight, stem fresh weight, stem dry weight as well as NPK content and uptake in leaves were increased by the application of proposed fertilization treatments as compared to control.

Syamsuwida *et al.* (2015) [27] concluded that seedlings quality can be improved by giving a treatment of 2.5 g mycorrhiza + 1.0 g NPK fertilizer in *Pongamia pinnata.*

Patil and Krishna (2016) [22] performed a nursery experiment to study the effect of organic, inorganic and bio-fertilizers on seedling growth parameters in canes (*Calamus thwaitesii* and *Calamus nagabettai*) and found that the higher seedling height, collar diameter and number of leaves was observed in treatment constituting (T_2) vermicompost (20 g/seedling) and vermicompost + 2 g NPK per seedling (T_6).

Patel and Suresh (2018) [21] carried out a study to know the influence of different blends of chemical fertilizers, bio-fertilizers and organic fertilizers on quality seedling production in *Swietenia macrophylla* King. The results showed that the 120 DAT treatment with 1g NPK + vermicompost (50 g) + Azophos (5 g $seedling^{-1}$) performed significantly better in visual parameters such as shoot length (53.47 cm), root length (39.71 cm), collar diameter (3.63 mm), leaf area (cm^2), and number of leaflets (27.1), quality indices such as volume index (7.03 cm^3), quality index (0.2661), and sturdiness quot (3.306 mg g^{-1}).As a result, the optimal nutrient mixture of 1g of each NPK with vermicompost (50 g) and Azophos (5 g) $seedling^{-1}$ was appropriate for producing quality seedlings with a shorter nursery stay.

References

1. Al-Hadethi MEA, AL-Dulaimi AST, Almashhadan BMK. Influence of biofertilizers on growth and leaf mineral content in peach transplants. Journal of Agriculture and Veterinary Science. 2017;10(9):90-93.
2. Anand B. Studies on effect of seed treatment and nutrient management in Melia dubia Cav at nursery stage M. Sc. (For.) Thesis, University of Agricultural Science, Bangalore (India). 2011.
3. Atik A, Yılmaz B, Asla F. Effects of three different concentrations of vermicompost on the growth in 2+0 aged seedlings of Anatolian black pine. International Journal of Agriculture, Forestry and Fisheries. 2015;3(2):25-31.
4. Bhuiyan MZ, Hossain MK, Osman KT. Effect of inorganic fertilizers on the initial growth performance of *Casuarina equisetifolia* seedlings in the nursery. Indian Journal of Forestry. 2000;23(3):296-300.
5. Biradar AP, Devaranavadagi SB, Sunitha ND. Effect of vermicompost as potting media mixture on growth and vigour of neem seedlings. Karnataka Journal of Agricultural Science. 2001;14(2):514-515.
6. Dash S, Mohapatra AK, Gupta N. Growth response of *Dalbergia sissoo* Roxb. to mineral solubilizing bacteria and fungi in nursery conditions. Tropical Ecology. 2013;54(1):109-115.
7. Devaranavadgi SB, Wali SY, Patil SB, Jambagi MB, Kambrekar. Effect of nursery mixtures on nutrient content and quality parameters of seedlings of different tree species. International Journal of Agriculture Science. 2010;6(2):365-369.
8. El-Dengawy EFA, Hussein AA, Alamri SA. Improving growth and salinity tolerance of Carob seedlings (*Ceratonia siliqua* L.) by *Azospirillum* inoculation. Journal of Agriculture & Environmental Science. 2011;11(3):371-384.
9. El-Quesni FE, Hashish KI, Kandil MM, Mazhe AA. Impact of some biofertilizers and compost on growth and chemical composition of *Jatropha curcas* L. World Applied Sciences Journal. 2013;21(6):927-932.
10. Haggag LF, Merwad MA, Shahin MF, Amira A. (2014). Effect of NPK and bio-fertilizers as soil application on promoting growth of "Toffahi" olive seedlings under greenhouse condition. Journal of Agricultural Technology. 2013;10(6):1607-1617.
11. Kannur S, Devar KV. Effect of fertilizers on seedling growth of teak. My Forest. 2003;39(2):153-157.
12. Khamis MH, Atia MG, Ali HM. Impact of nitrogen and phosphorus sources on growth efficiency of *Melia Azedarach* and *Populus euphratica* in Wadi El Natrun, Egypt. Journal of Forest Products and Industries. 2013;2(5):13-19.
13. Kumar R. Effect of doses and methods of phosphorus application on growth of *Populus deltoids* under nursery conditions. Indian Journal of Forestry. 2006;29(3):267-269.
14. Kumar S, Siddiqui MH. Role of NPK fertilizers on early production of plantable seedling of *Terminalia arjuna* Bedd. Journal of Research, Birsa Agricultural University. 2004;16(2):341-345.
15. Lamani N, Shivaprasad D, Swamy KR, Manikhantha M Vaidya, Rathod R. Effect of elevated carbon dioxide concentration on photosynthetic and transpiration rate in Sandal (*Santalum album* L.). Proceedings the International Academy of Ecology and Environmental Science. 2016;6(2):44-52.
16. Lebba JJ. Studies on seed biology, pre-sowing treatments and nutrient response in *Melia dubia* Cav. M.Sc. (For.) Thesis, University of Agricultural Science, Dharwad (India). 2011.
17. Maharana R, Dobriyal MJ, Behera LK, Sukhadiya M. Enhancement of seedling vigour through bio-fertilizers application in gamhar (*Gmelina arborea* Roxb.). International Journal of Chemical Studies. 2018;6(5):54-60.
18. Manikantha MV, Shivaprasad D, Lamani N, Swamy S, Kotresh KR, Dasar GV. Effect of *in-situ* moisture conservation measures and application of organic manures on soil properties in *Simarouba glauca* plantation. International Academy of Ecology and Environmental Sciences. 2016;6(3):84-96.
19. Mishra RK, Channabasappa KS. Effect of integrated nutrient management on *Tectona grandis* (Linn.f.) with special reference to biofertilizers. *M.Sc. (Fort.) Thesis*, University of Agricultural Science, Dharwad, Karnataka (India). 2013.
20. Mohan E, Rajendra K. Effect of plant growth-promoting microorganisms on quality seedling production of *Feronia elephantum* (Corr.) in Semi-Arid Region of Southern India. International Journal of Current Microbiology and Applied Science. 2014;3(7):103-116.
21. Patel NV, Suresh KK. Effect of fertilizers on quality seedling production in *Swietenia macrophylla* King. International Journal of Chemical Studies. 2018;6(3):2655-2660.
22. Patil SS, Krishna A. Influence of organic, inorganic and bio-fertilizers on seedling growth in Canes, International Journal of Pure and Applied Bioscience. 2016;4(5):202-211.
23. Raman KR, Sharma MS, Sivaji, Mahato GP. Effect of FYM and its combination with fertilizers on growth, biomass production and quality of *Dalbergia sissoo* Roxb. seedlings. Indian Journal of Agroforestry. 2008;10(2):71-74.
24. Revathi R, Mohan V, Jha MN. Integrated nutrient management on the growth enhancement of *Dalbergia* sissoo Roxb. seedlings. Journal of Academia and Industrial Research. 2013;1(9):550-555.
25. Shetta ND, El-Sayed AWB, Nasr TA, Shaarawy NM. Influences of mineral fertilization with NPK, inoculation and methods of inoculation on seedling growth of two woody legume trees. World Applied Science Journal. 2014;29(7):825-834.
26. Sumbli S, Koppad AG. Effect of *in-situ* moisture conservation structures and application of manures and fertilizer on growth of *Acacia auriculiformis*. Karnataka Journal of Agricultural Science. 2013;26(4):528-533.
27. Syamsuwida D, Putria KP, Rina Kurniatya, Aminah A. Seeds and seedlings production of bioenergy tree species Malapari (*Pongamia pinnata* (L.) Pierre). Energy Procedia. 2015;65:67-75.

28. Thriveni HN, Gunaga RP, Vasudeva R. Influence of inorganic fertilizers on seedling growth and biomass of *Nothapodytes nimmoniana*, an important anti-cancer drug yielding tree species of Western Ghats. Biomedical Science. 2010;3(1):36-41.
29. Tiwari P, Saxena AK. Effect of different soil mixtures and fertilizers on the growth of *Dalbergia sissoo* seedlings. Indian Journal of Agroforestry. 2003;23(3):254-259.
30. Uddin MB, Mukul SA, Hossain MK. Effect of organic manure on seedling growth and nodulation capabilities of five popular leguminous agroforestry tree components of Bangladesh. Journal of Forest Science. 2012;28(4):212-219.
31. Vijayanathan M, Kumar G, Gopi D. Influence of vermin products on growth and biomass production of tree borne oil seedlings of pongam (*Pongamia pinnata*). Journal of Non Timber Forest Products. 2005;12(3):161-165.