Original Research Article

Standardization of Nursery Media through Nutrient Analysis

ABSTRACT

An experiment was conducted in the Soil testing laboratory PLANTICA – Indian Academy of Rural Development, Dehradun during January – July 2023, which focused on the nutrient analysis of various growing media for nursery development. Growing media is a crucial component of nursery cultivation as it aids in the growth and development of plants. Different types of growing media are used, and one of them is soil-based media, which is a mixture of different materials with soil being the primary component. In this trial, a mixture of soil, sand, vermicompost, and cocopeat was used to create growing media with different ratios. In this experiment completely randomized design (CRD) was used, in which soil and sand were mixed together to form one treatment, while cocopeat and vermicompost were mixed with soil and sand in different ratios, resulting in a total of 13 treatments with 4 replications each. The treatments for this experiment were, as follows: T1 - soil, T2 - soil + sand (1:1), T3 - soil + sand + cocopeat (1:1:1), T4 - soil + sand + cocopeat (1:1:2), T5 - soil + sand + cocopeat (1:1:3), T6 - soil + sand + vermicompost (1:1:1), T7 - soil + sand + vermicompost (1:1:2), T8 - soil + sand + vermicompost (1:1:3), T9 - soil + sand + cocopeat + vermicompost (1:1:1:1), T10 - soil + sand + cocopeat + vermicompost (1:1:1:3), T11 - soil + sand + cocopeat + vermicompost (1:1:2:1), and T12 - soil + sand + cocopeat + vermicompost (1:1:3:1). To analyse the nutritive value of the growing media, NPK (nitrogen, phosphorus, potassium), organic carbon, electrical conductivity (EC), pH, and water holding capacity were measured. The most suitable treatments for nursery n cultivation were found to be T9 (soil, sand, cocopeat, and vermicompost with a ratio of 1:1:1:1) and T11 (soil, sand, cocopeat, and vermicompost with a ratio of 1:1:1:3). These treatments had the perfect balance of soil, sand, vermicompost, and cocopeat, providing all the necessary nutrients required by the plants. T9 was particularly suitable for nursery beds due to its high phosphorus content, which is beneficial for root development. On the other hand, T11 was the best choice for growing media after transplanting the saplings as it contained a high nitrogen content, which promotes foliage development.

INTRODUCTION

Nursery cultivation is a widely recognized and practiced activity that involves the cultivation of various plant materials such as seedlings, saplings, trees, and shrubs. It is a highly intensive practice that requires a great deal of effort to raise and maintain the plants in good condition. The growing medium used in horticulture nurseries plays a crucial role in determining the success of cultivation. The growing medium comprises numerous components that assist the young plant's roots in growing and absorbing nutrients. Additionally, it provides water and air through pore spaces, supporting the growth of the plants.There are two main types of growing media available in the market, namely soil-based and soilless or organic-based. Organic media or soilless media are comprised of organic materials such as compost, peat, cocopeat, or other organic materials mixed with inorganic matter (1). On the other hand, soil-based growing media include inorganic components like perlite, pumice, vermiculite, sand, etc. While organic media may not be widely available throughout the country, soil-based media can be used as an alternative for nursery management in resource-limited environments.Various soil textures combined with vermicompost in a fixed ratio can be used as one of the soil-based media for growing plants(1). The essential nutrients required in the growing media are Nitrogen, Phosphorus, and Potassium. To assess the quality of the growing media, parameters such as Electrical Conductivity (EC), pH, and water-holding capacity are used. Water-holding capacity refers to the percentage of total pore space that remains filled with water after drainage (2). A good growing medium has a high water-holding capacity while also containing enough macropores to allow excess water to drain and prevent waterlogging. The water-holding capacity varies depending on the types and sizes of the growing medium ingredients (2).The pH of the growing medium is a measure of its relative acidity or alkalinity. EC refers to the ability of a growing medium to hold positively charged ions. The combination of soil textures and vermicompost in a fixed ratio can be used to create a suitable growing medium for various plant materials. The growing medium must comprise the right mix of inorganic and organic components to support the plant's growth. The use of growing media in nursery cultivation is an essential aspect of modern horticulture. The right choice of growing medium can make the difference between success and failure in nursery cultivation.The growing medium provides the necessary physical support, water, and nutrients required for the growth of the plant. It is an essential component for the successful cultivation of various plant materials. The quality of the growing medium is determined by its physical properties, such as texture, porosity, and water-holding capacity. The chemical properties of the growing medium, such as pH and EC, also play a crucial role in the success of cultivation (3).The growing medium should be free from pests, diseases, and weed seeds to ensure the healthy growth of the plant. The use of contaminated growing media can have a detrimental effect on the growth and development of the plant (3). Proper storage and handling of the growing medium are also essential to maintain its quality. The growing medium should be stored in a cool, dry place, away from direct sunlight and moisture.

MATERIAL AND METHOD

The experiments of this trial were conducted in the Soil testing Laboratory of PLANTICA- Indian Academy of Rural Development, Dehradun, Uttarakhand. Completely randomized design (CRD) was used in this trial, where 13 treatments were taken with 3 replications (Table-1), by mixing sand, cocopeat, and vermicompost (Esineafoetida) in different ratios using containers with a volume of 439.21 gm/cm3.

The chemical and physiochemical parameters were Nitrogen, Phosphorus, Potassium, Organic-Carbon, pH and EC whereas physical characteristic of media was analysis by water holding capacity (4). For determining the available nitrogen present in prepared media, the Kjeldahl method (1883)was used at 100^0c in Kjeldahl distillation unit with 0.02 N H2SO4 in ml required for titration (5). To calculate Available Phosphorus, Spectrophotometer was used at wavelength of 880nm whereas Available Potassium was measured by Digital Flame Photometer. For analysis of organic- Carbon, Walkley and Black's (1934) method was used. The value of pH and EC was analysis by Auto Digital pH meter and Digital Conductivity Meter respectively(5). For ANOVA and other statistical data analysis MS Excel software was used.

Table-1 Number of Treatment with a ratio

Treatment	Ratio
Soil (T1)	1
Soil+ sand (T2)	1:1
Soil+ sand + cocopeat (T3)	1:1:1
Soil + sand + cocopeat (T4)	1:1:2
Soil + sand + cocopeat (T5)	1:1:3
Soil +sand + vermicompost (T6)	1:1:1
Soil+ sand + vermicompost (T7)	1:1:2
Soil +sand + vermicompost (T8)	1:1:3
Soil+sand+cocopeat+ vermicompost (T9)	1:1:1:1
Soil + sand + cocopeat +vermicompost (T10)	1:1:1:2
Soil + sand + cocopeat + vermicompost (T11)	1:1:1:3
Soil+sand + cocopeat + vermicompost (T12)	1:1:2:1
Soil + sand + cocopeat + vermicompost (T13)	1:1:3:1

RESULTS ANDDISCUSSION

The experiment conducted aimed to evaluate the efficacy of different combinations of soil, sand, cocopeat, and vermicompost in enhancing the quality of soil. Among the various treatments, it was found that the mixture with a ratio of 1:1:1:1 (T9) and the mixture with a ratio of 1:1:1:3 (T11) yielded the best results. This finding highlights the positive impact of vermicompost and cocopeat on soil quality when used in appropriate proportions. Specifically, the T9 treatment was deemed suitable for nursery beds due to its ability to provide an adequate amount of phosphorus necessary for proper root development in plants. On the other hand, the T11 treatment proved to be most beneficial after transplanting young saplings, as it exhibited a high nitrogen level in the growing media, which is essential for foliage development in plants. It is worth noting that the soil-based mixture used in this experiment offers a more cost-effective alternative to organic-based mixtures, as soil and sand are widely available, and cocopeat and vermicompost can be easily obtained from local markets. Although a comprehensive study specifically related to this experiment could not be found, it is possible to draw connections with a previous study that examined the effects of different growth media on the germination and growth of tomato seedlings(6). In that study, the researchers examined the impact of peat, compost (vegetable waste), and traditional media (consisting of soil, sand, and farmyard manure) both individually and in combination on the quality of tomato seedlings. The optimal growth of tomato-affected seedlings was observed when peat, compost, and traditional media were used in equal proportions. Similarly, another study investigating the growth performance of Clinacanthus nutans (Sabah snake grass) tested different growing media, including various combinations of soil, coco peat, and peat moss (7). This study measured various parameters such as plant height, number of leaves, number of side branches, length of side branches, root length, and root weight. The findings indicated that the use of a soil mix with peat moss significantly affected plant height, number of leaves, length of side branches, root length, and root weight. Furthermore, a separate experiment conducted at Purdue University, West Lafayette, aimed to evaluate the chemical indices of growing media for nursery production of Quercus rubra seedlings. This experiment involved three different media formulations or substrates (A, B, and C) composed of composted pine bark, coconut coir pith, sphagnum peatmoss,processed bark ash, and perlite in varying proportions for growing northern red oak seedlings(8). The substrates were ranked based on their ability to promote seedling growth, with substrate A yielding the lowest results due to the absence of pine bark and perlite, substrate B lacking peatmoss or processed bark ash, and substrate C containing all components (8). The analysis revealed that the nutritional limitations on seedling growth could be effectively ranked as nitrogen (N) being the most limiting element, followed by phosphorus (P) and potassium (K). Additionally, it was observed that high nitrogen fertilization accentuated element deficiencies in seedlings grown on substrate A.

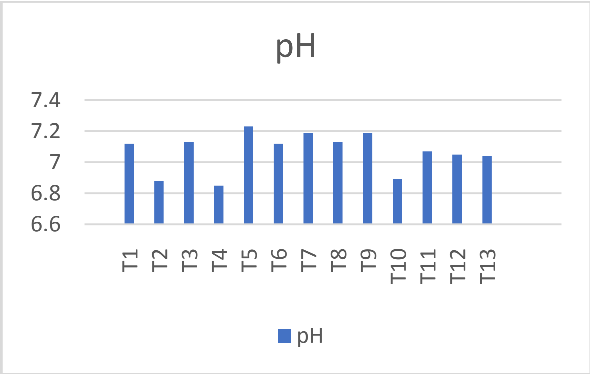
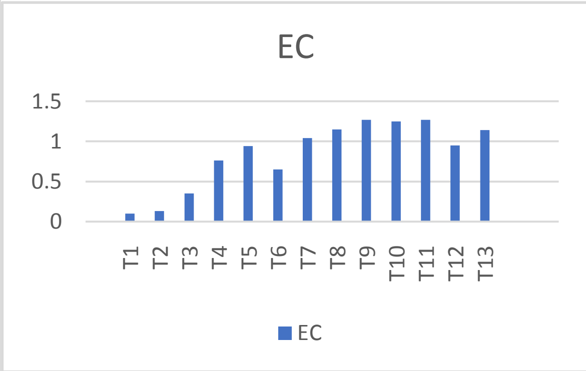


Fig 1



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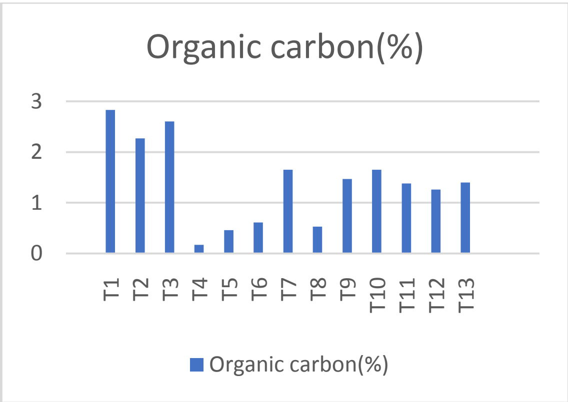
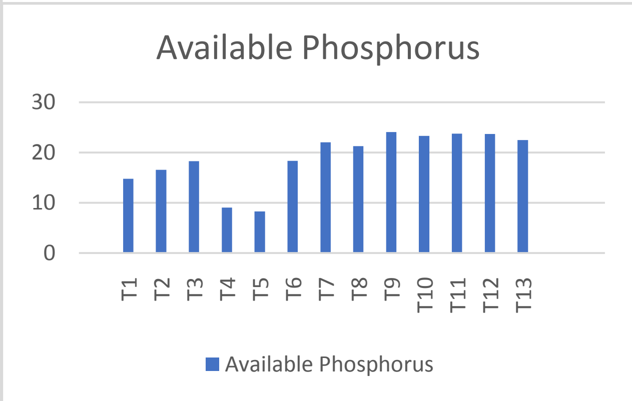


Fig 3 :



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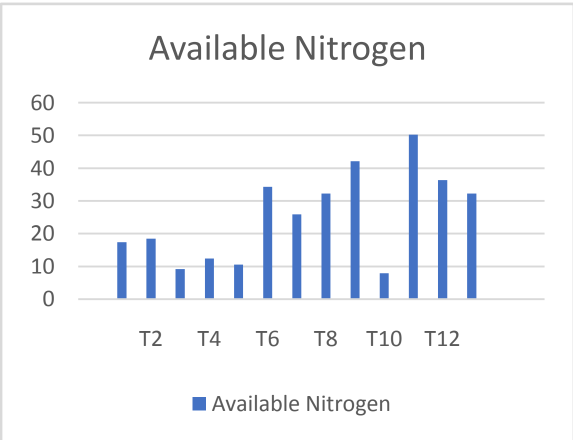

Fig 5 :

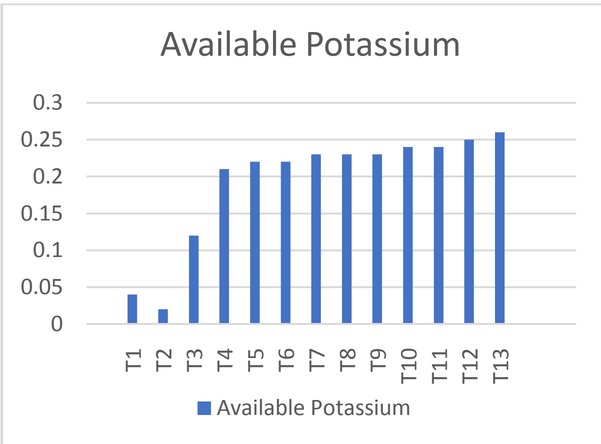

Fig 6 :

Fig 1-6: Graphical represeantation between treatment deatails with other parameters.

Table-2: Physical and Physiochemical characteristics of growing media

Treatment	Water holding capacity (%)	EC	pH	Organic carbon (%)	A N (%)	A P_2O_5 (%)	A K_2O (%)
T1	38.00 ± 0.0	0.1 ±0.00	7.12±0.05	2.83±2.72	17.40 ±1.04	14.75 ±0.13	0.04 ±0.002
T2	27.0 ±8.08	0.13 ±0.01	6.88±0.09	2.27±0.64	18.46 ±1.55	16.58 ±0.27	0.02 ±0.0009
T3	36.63±3.09	0.35 ±0.02	7.13±0.06	2.60±1.71	9.17 ±1.49	18.28 ±0.39	0.12 ±0.001
T4	44.75±0.96	0.76 ±0.01	6.85±0.11	0.17±0.05	12.38 ±0.98	9.05 ±0.76	0.21 ± 0.000
T5	58.00±0.00	0.94 ±0.04	7.23±0.10	0.46±0.04	10.58 ±0.73	8.28 ±0.36	0.22 ±0.0007
T6	27.50±1.91	0.65 ±0.01	7.12±0.07	0.61±0.24	34.31 ±0.47	18.34 ±0.28	0.22 ±0.0006
T7	28.75±1.50	1.04 ±0.03	7.19±0.08	1.65±0.09	25.87 ±2.45	22.02 ±0.40	0.23 ±0.0009
T8	28.25±1.26	1.15 ±0.02	7.13±0.08	0.53±0.40	32.23 ±0.14	21.25 ±0.56	0.23 ±0.0007
T9	34.25±3.86	1.27 ±0.02	7.19±0.27	1.47±0.09	42.11 ±1.66	24.1 ±0.98	0.23 ±0.0019
T10	41.00±3.83	1.25 ±0.04	6.89±0.11	1.65±0.05	7.96 ±1.10	23.3±1.10	0.24 ±0.0013
T11	33.00±4.76	1.27 ±0.02	7.07±0.06	1.38±0.03	50.25 ±4.93	23.75 ±0.35	0.24 ±0.0018
T12	45.00±2.58	0.95 ±0.03	7.05±0.04	1.26±0.07	36.40 ±2.59	23.67±0.17	0.25 ±0.0024
T13	52.13±0.25	1.14 ±0.02	7.04±0.04	1.40±0.00	32.28 ±4.18	22.50±0.16	0.26 ±0.0017
SE ±	2.47*	0.09*	0.02*	0.47*	1.79*	0.45*	0.00*

*Significant (P=0.05)

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